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QUEENSLAND AGRICULTURAL JOURNAL

Dairy Pastures on the Maleny Plateau.

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Fodder Cane
Storing Grass Seed
Passion Fruits and Granadillas
Honey Flora
Gladiolus Thrips
Growing Fat Lambs
Joining Sheep
Dehorning Cattle
Lumpy Jaw of Cattle

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(Lists of extension services in Central and North Queensland will appear in the next issue.)

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Tuberculosis-Free Cattle Herds.

TESTED HERDS (As at 22nd September, 1954).

The Tuberculosis-Free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements.

The studs listed here have fulfilled the conditions to the date shown above.

Full particulars of the scheme and Agreement for Testing forms may be obtained from the Under Secretary, Department of Agriculture and Stock, Brisbane, or from Divisional Veterinary Officers throughout the State.

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus" Stud, Greenmount H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy Sullivan Bros. "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer" Stud, Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest" Stud, Wondai W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman W. H. Thompson, "Alfa Vale," Nanango S. R. Moore, Sunnyside, West Wooroolin H.M. State Farm, Numinbah D. G. Neale, "Groveley," Greenmount Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah W. D. Davis, "Wamba" Stud, Chinchilla Queensland Agricultural High School and College, Lawes C. K. Roche, Freestone, Warwick Mrs. K. Henry, Greenmount D. R. Green, Deloraine Stud, Durong, Proston E. Evans, Wootha, Maleny
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount J. F. Lau, "Rosallen" Jersey Stud, Goombungee G. Harley, Hopewell, M.S. 189, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango F. W. Verrall, "Coleburn," Walloon C. Beckingham, Trouts road, Everton Park W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala G. H. Ralph, "Ryecombe," Ravensbourne Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick J. W. Carpenter, Flagstone Creek, Helidon H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
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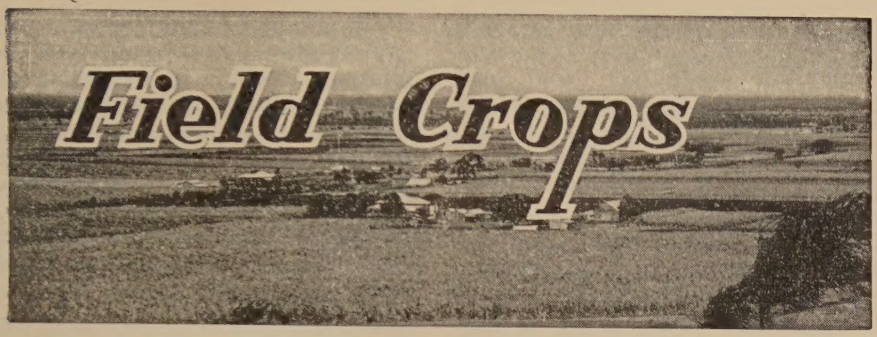

Fodder Cane—A Useful Fodder Reserve on Farms.

By O. L. HASSELL, Senior Adviser in Agriculture.

Fodder cane has been grown for feeding to dairy stock for many years in districts such as the Atherton Tableland, Eungella Range, Gympie district and in scattered areas along the Queensland coast. Statistical records indicate that approximately 4,000 acres are devoted annually to fodder cane production.

As a means of providing good succulent roughage during most dry spells, the growing of fodder cane in these districts has been found most satisfactory. Known by farmers as cowcane, this valuable fodder crop is capable of producing a large tonnage of stalk and green material per acre.

The amount of labour required in harvesting and feeding the crop is usually well repaid, especially during dry periods.

Fair average analyses of lucerne, pasture and cowcane are shown below:

Suitable Soils and Locations.

For best results, fodder cane requires a well-drained soil, rich in organic matter, such as the alluvials and most of the scrub soils. Poorer types of soil will grow good crops of cane provided the land has had a liberal dressing of farmyard manure and commercial fertilizer.

There are very few farms on the coastal belt of Queensland on which a small area suitable for the production of an average crop of fodder cane could not be found.

A matured crop of cane will resist a fairly heavy frost. In a severe frost the outside rows of matured and well-grown crops are likely to be severely damaged and portion of the top badly burnt, but the stalk and portion of the top will provide good fodder. A thin crop of cane or an immature crop is likely to be ruined by a heavy frost. In selecting an area for planting to fodder cane, a major consideration

Crop	Moisture	Water-Free Materia						
		Protein	Fat	Carbo-hydrates	Fibre	Ash	Lime	Phos-phoric acid
	%	%	%	%	%	%	%	%
Lucerne	71·3	22·4	1·2	39·3	25·6	10·0	2·24	·81
Pasture	64·4	12·2	2·2	47·2	27·1	11·2	·583	·340
Cowcane ..	71·4	4·6	0·9	60·8	28·7	5·1	·372	·293

should be its freedom from heavy and continuous frosts.

Preparation of Land.

Although cane is a hardy plant, it will not yield well unless the land is well worked and thoroughly prepared. Ploughing should be to a depth of at least eight inches. Early preparation of the land is necessary. The first ploughing should be made during the winter and followed by a cross ploughing and a thorough working down just before planting. A well prepared seedbed will pay dividends.

Planting.

Plantings may be made in the southern districts from September to March, in the central district from July to December, and in the northern districts from April to December, depending, of course, on the condition of the soil. In southern districts a planting period of September-October should be aimed at if a useful plant crop is to be harvested in the following winter and spring.

Sets averaging 12–15 in. in length and having two or three eyes are commonly used. The spacing is usually 3 in. between the sets in the row, allowing approximately two sets per yard. Rows may be spaced 4 ft. 6 in. or 5 ft. apart; the former spacing will require about 6,500 sets per acre and the latter 5,800. In most sugar-cane areas the sets are planted with a machine, but in small areas for fodder purposes this is not necessary. Planting drills are ploughed 6–8 in. deep. The sets are placed flat along the bottom of the drill and it is an advantage if they can be trampled firmly into position. The person carrying out this work usually walks along the bottom of the drill, dropping the sets at regular intervals and pressing them in with his feet, but at the same time avoiding any damage to the buds.

The sets should be covered with two to three inches of soil immediately after planting. As germination proceeds, light cultivation should be carried out to control weed growth.

Plate 1.

CP 29/116 Fodder Cane on a Caboolture Farm. This picture was taken in September 1953 and shows a splendid first ratoon crop 12 months after cutting the plant crop.

In the early stages of growth the drills should be kept fairly open to promote stooling, and later, as growth proceeds, the soil is gradually worked in around the growing plants until the field is practically level. A light rate of covering should be used during cool weather, as deep covering of the sets at this period is liable to result in a poor germination.

Unless there is some urgent reason for planting a large area, it is cheaper to plant a small area from which plants can be secured for expansion during the following season. It is possible to secure 1,300–2,600 sets per chain from an average crop of cane. Some of the thin-stalk varieties will produce 20–30 canes per stool.

Regulations Governing Movement of Cane Sets

Queensland is divided into quarantine districts for cane distribution in order to prevent the transfer of diseases of sugar cane from one district to another. As fodder canes are subject to the same diseases as those which infect the better known commercial varieties, it is very necessary that the same quarantine regulations be observed in distributing sets in order to prevent disease dissemination. Your local Departmental officers will be able to give advice on this matter.

The quarantine districts are—Mossman, Cairns to Johnstone, Herbert, Lower Burdekin, Proserpine to Mackay, Plane Creek, Bundaberg to Childers, Maryborough, Moreton, and Logan. Before cane can be transported from one district to another, a permit must be obtained from the Bureau of Sugar Experiment Stations, William Street, Brisbane.

Fertilizers and Manures.

On the poorer coastal soils which are lacking in organic matter, it is advisable, where practicable, to add a liberal dressing of farmyard manure before planting. This may be broadcast over the land and ploughed in before planting, or placed along the bottom of a deep furrow.

Plate 2.

Another Crop of CP 29/116. This is a third ratoon crop, which was in process of yielding its fourth cut from the one planting.

On fertile soils, especially where a leguminous cover crop has been ploughed in, no fertilizer may be necessary in the plant crop. However, with the ratoons the use of nitrogenous fertilizers will almost certainly be necessary for best growth.

Advice on complete cane fertilizer mixtures for the different soil types can be secured from Departmental officers or from the various fertilizer companies. On poor soils it is preferable to use a complete mixture for each crop, and add a supplementary dressing of sulphate of ammonia when the cane is shoulder-high. Cane will not yield well on poor land unless it is well fertilized.

Cultivation and Ratooning.

The number of times that fodder cane can be ratooned will depend to a large extent on the variety. Some varieties will yield reasonably well after the fourth or fifth ratoon. Others are not profitable to keep after the second ratoon.

The method of ratooning usually adopted is to plough away from the row of cane when the shoots are about six inches long, and to apply the fertilizer on both sides of the cane. The furrow against the cane should cut away portion of the stool. The soil should be thrown back to the cane as soon as possible after the application of the fertilizer; this is necessary to prevent undue drying out of the stool.

The trash should not be burnt, if it is at all possible to avoid this practice. From the viewpoint of soil conservation, if no other, it is recommended that the trash should be chopped into the soil between the rows with some type of disc implement, or conserved by piling into every second or third interspace.

Normal cultivations with light tined implements should be carried out whenever it is necessary to control weed growth. Once the cane "covers in," no further cultivation is required.

Yields.

The yield per acre that can be expected from a crop of fodder cane will depend on the variety, the suitability of the soil and the weather. Grown under normal conditions, at least 30 tons per acre of stalk and green material can be expected, while over 60 tons per acre can be obtained when grown under ideal conditions.

Varieties.

Special attention should be paid to the variety of cane planted, as the choice of variety may have a tremendous effect upon the yield over a period of three or four years. Some of the most serious disabilities in a fodder cane are (1) susceptibility to disease; (2) early arrowing (flowering), which generally means poor stand-over properties; (3) poor ratooning capabilities; and (4) susceptibility to frost. These characteristics have been taken into consideration in making the following varietal recommendations.

Far North Coast and Atherton Tableland.—Improved Fodder Cane, Co.301, and China.

Central Coastal Districts.—China, Improved Fodder Cane, and Co.301.

South Coastal Districts.—Co.301, CP 29/116, China, and, in frost-free locations, Q.60 (known during its testing period as A130).

Harvesting.

Plant Cane.—The cane may be cut at any period during its growth without damaging the stools, provided frost is not a limiting factor. However, the greatest bulk can be secured if the crop is allowed to mature. While most of the fodder canes in use require 12–14 months for their plant crops to mature, harvesting may start at 7–9 months according to the variety and the time of planting.

Ratoons.—Ratoon crops normally mature at 10–12 months from the time of previous cutting. If ratooning is well carried out the ratoon crops may

be very similar to the plant crop, but their yields may be expected to become progressively lighter.

Harvesting for stock fodder is usually carried out by hand, a cane-knife being used to cut the stalks near ground level.

Method of Feeding.

The most common method of feeding cane is to spread the stalks around a paddock and allow the stock to eat what they require.

While all the material spread out may be eaten, it is a wasteful method of feeding, as a large percentage of the juice from the stalk runs to the ground when the cane is being chewed by the beast. The chaffing of the material entails additional work, but it provides a much more economical way of feeding, as there is no waste whatever. Feeding of chaffed material also enables some control to be exercised over the balance of the ration by adding a high-protein feed.

Approximately 25 lb. of fodder cane per day with a little concentrate will keep a dry cow in fair condition. This means that an acre of cane yielding 30 tons per acre will keep a herd of 30 dry cows in fair condition for approximately 90 days—that is, of course, with the addition of the necessary concentrate.

When fed with such green feeds as lucerne, cowpeas, field peas, millets and oats, fodder cane will provide the bulk for a cow in production. When feeding as a mixture to a cow in production the quantity of cane in the ration would have to be increased to

Plate 3.

Co. 301 Fodder Cane on the Same Farm as Plate 1. This was also a first ratoon crop, ready for cutting in September, 1953.

35 lb. per day. Cowcane has a low protein content and although when fed alone it will keep an animal in satisfactory condition, it will not produce milk.

Cane makes a fair ensilage if chaffed or shredded.

Conserving Trash.

It is a common practice to burn off trash after the cane has been harvested, to enable ratooning and cultivation of the crop. This practice is not recommended, as every effort should be made to conserve all the available material so as to protect the soil from erosion and improve its condition. The chopping roller or disc cultivator will be found useful in breaking up the trash before it is partly ploughed under.

In some areas it is considered a good practice to fork all the trash from two rows into each third interspace, leaving the trash to rot down until the next season. In this way two interspaces are cultivated and the third holds the trash. The following season the practice is rotated, so that a different series of trash rows is used. This method of dealing with the trash is valuable in hillside cultivations.

Irrigation.

No crop responds better to irrigation than cane. In most districts where cane is grown the number of irrigations required in normal seasons would not average more than four. The extra cost involved would be well repaid.

Plate 4.

A Plant-Cane Crop of Q. 60 at Caboolture. This crop is only 10 months old and has not yet reached maturity. If cut at this stage, however, it would still provide a good tonnage of fodder and permit subsequent ratooning.

Irrigation Practice in Queensland.

Part 7. Water Requirements of Irrigated Crops.

By A. NAGLE, Irrigationist, Agriculture Branch.

Water requirements of irrigated crops have been defined as "water duty," "consumptive water use" and "irrigation water requirements."

These terms indicate the amount of crop production per unit of water applied, but take no account of rainfall and moisture stored in the soil prior to irrigation. They are assumed to have a general application for irrigation practice and imply the quantity of water used to supplement rainfall in the production of crops.

The water requirements of irrigated crops vary considerably, as a number of factors are involved. Soil type, moisture-holding capacity of the soil and subsoil, state of preparation of the land, method and skill of application, all influence the amount of water required for best crop production.

Cultivation after crop establishment also affects the amount of water required. Clean cultivation may reduce competition for moisture through controlling weed growth and may reduce evaporation from the soil where the water-table is within capillary range of the ground surface. A complete ground cover or shading of the surface soil also reduces loss of moisture by evaporation. Temperature and humidity also have an effect on evaporation losses.

The aim in irrigation practice is to supply only the water required to produce the most economical crop yield. Not only is the excessive use of water uneconomical, but it is important to realise that there is a definite limit to the quantity of water which should be applied to the soil. Applications of excessive water will not only reduce yields but can have a detrimental effect on soil fertility and soil structure.

There is a *maximum* application of water which will produce *maximum* yields, but usually a maximum application is uneconomical. The best or most profitable yield is the objective to be attained. In practice, it has been found that the best yield and the appropriate application of water are lower than the maximum rates, normally being equivalent to about 75% of the maximum rates.

Leaching of plant foods below the root zone can follow excessive irrigation. The building up of shallow water-tables (that is, the level of free water in the soil) and the raising of soil salinity in irrigation areas in the southern States have been due primarily to overwatering associated with poor internal drainage. Experimental work in New Mexico, U.S.A. on a clay loam soil overlying a porous sand at 2 ft. 6 in. has shown that an irrigation at the rate of 4 inches, following the application of 600 lb. sulphate of ammonia, leached nitrate nitrogen equivalent to 200 lb. sulphate ammonia from the 0–30 in. soil level, this amount being lost to the crop being irrigated.

The amount of water required for maximum yield varies with various soils and for different crops. The aim of the irrigator should be to supply sufficient moisture to the root zone of the crops throughout the growing season. Any water applied in excess of this amount is lost by percolation and in surface drainage water. The rooting habit of the

crop irrigated influences the frequency of irrigation, and the total quantity of water applied at each irrigation is governed to some extent by the soil type irrigated.

Only limited information is available on the water requirements of various crops grown in Queensland, but an endeavour has been made in the following sections to summarise the information that is available, for the guidance of irrigators.

Lucerne.

It is generally accepted that a well distributed rainfall of 48 in. per annum is required for maximum growth of lucerne under Queensland conditions, so in the Lockyer district, with an average annual rainfall of 28 in., it can be expected that about 20 in. of irrigation water would be required to supplement rainfall.

Although lucerne has a deep rooting system, about 80-90% of the roots are concentrated in the 0-4 ft. zone of soil, so wetting the soil regularly below that depth would be uneconomic and wasteful usage of water.

Frequency of irrigation of lucerne is largely dependent on soil type. For deep loamy soil with good water penetration, one irrigation per cutting may be sufficient. For sandy soils with free penetration or soils of shallow depth where only poor penetration is found, several light irrigations per cutting may be required.

The seasonal growth of lucerne may determine frequency of irrigation; during cool weather, when growth is slow, fewer irrigations will be required than in hot dry weather, when temperature conditions are favourable for rapid growth.

During hot weather, when scalding may occur following watering on heavy soils, some authorities suggest watering before cutting, as the shading of the ground by the standing crop lowers temperature and evaporation. The disadvantages of this method are the slower curing of the hay on the moist ground and the difficulty of watering a heavy stand of lucerne by the border method unless big heads of water are available. Actually, experimental work has shown that there is little difference in the yield of lucerne cut before or after watering provided that the soil is not allowed to become too dry.

Night irrigation is often employed to avoid scalding of lucerne during hot weather. Experience at Gatton has indicated that scalding has not occurred where grading of the land has been done carefully and a good outfall provided for drainage water.

A lucerne experiment, to test out the effectiveness of three methods of water application (spray, furrow and border) was commenced at Gatton Irrigation Research Station in 1949 and continued for two years. The amount of water applied was equal for each treatment and all land used was graded to a uniform fall. No significant difference in yield was obtained. The trial was designed to demonstrate that correctly laid out border irrigation could be successfully employed for lucerne fields on heavy clay soils.

A summary of the four years' yields of lucerne hay grown under border irrigation at the Gatton Irrigation Research Station, showing amounts of irrigation water used and rainfall received, is given in the following table:—

Period.	Yield of Hay. (Tons per Acre).	Irrigation Water Applied.	Rainfall.	Total Water and Rainfall.
		Inches.	Inches.	Inches.
11–8–48 to 30–6–49—New Planting, 10 months' growth	7·5	30	21·8	51·8
1–7–49 to 30–6–50	7·89	25	43·35	68·35
1–7–50 to 30–6–51	6·60	12	38·01	50·01
1–7–51 to 30–6–52	6·95	24·5	21·33	45·83

These figures show considerable variation in water applied annually and also in totals of annual rainfall, while the highest yield obtained was 7.89 tons per acre in 1949-1950, when a total of 25 in. of irrigation was used in addition to 43.35 in. of rainfall.

Actually, several of the irrigations were rendered ineffective by heavy falls of rain following irrigations. These rains caused water-logging of the surface soil and depressed yields temporarily, but no scalding occurred.

The lucerne yield for 1950-51 was achieved in a year of good rainfall with low irrigation, and that of 1951-52 in a year of low rainfall with moderate irrigation. These yields are obviously not the maximum obtainable but they do closely approach the most profitable yields under irrigated conditions.

The results with lucerne irrigation at Werribee Research Farm, Victoria, show the following figures:—

6 waterings of 4 in. gave a yield of 7.1 tons per acre.

4 waterings of 6 in. gave a yield of 6.7 tons per acre.

8 waterings of 3 in. gave a yield of 6.4 tons per acre.

The average yearly rainfall at Werribee is 23.5 inches, fairly well distributed but heavier in the winter months, thus making a total of 47.5 in. per year. However, the effectiveness of the rainfall at Werribee would be greater than in Queensland, as distribution is more effective and evaporation and transpiration are lower. It is anticipated that in Queensland, with a longer growing season and higher temperatures, a heavier water consumption and more frequent irrigations would be required for maximum yields.

The spray method is used almost exclusively for irrigation of lucerne in Queensland. A small area of lucerne at Theodore is furrow irrigated, but there are no grounds for believing that this method has any advantage over efficient border irrigation.

Cereals.

While the production of cereal crops on a large scale with irrigation has not been attempted in Queensland, large areas of wheat are grown in the Riverina of New South Wales, with the aid of one or two irrigations, water being applied by the contour check bank method. The total water applied ranges from 4 in. to 8 in. and water charges per acre foot are low.

Where water is available, production of high-yielding crops of wheat and oats may be assured by the application of one light supplemental irrigation.

Sufficient moisture is essential for cereals during the shot blade and soft dough stages to produce well filled kernels. Irrigation applied after the soft dough stage has little effect on yield.

Hay and Fodder Crops.

The production of hay and green fodder crops is assured with he aid of supplemental irrigation. At Gatton Irrigation Research Station, the results with wheat and field peas, and giant setaria and Poona pea, respectively, indicated clearly that good yields of either green fodder or hay can be obtained with one supplemental watering at the rate of 2 in. during the summer growing period.

Border, furrow and spray methods have been used for irrigation of these crops.

In 1947, wheat and field peas yielded 15.5 tons green weight per acre for 10 weeks' growth, and in 1948 a yield of 14.3 tons green weight for 14 weeks' growth respectively.

Similarly, giant setaria and Poona pea in 1948 yielded 13.6 tons green material for 6 weeks' growth, and in 1949 a yield of 22 tons green weight was made in 10 weeks—a weekly growth rate of 2 tons per acre in both years.

Border, furrow and spray methods have all been used successfully for irrigation of these crops in trials, but commercial irrigation is practised to only a limited extent in Queensland.

Maize.

In Queensland, little maize is grown with irrigation for grain production, as generally maize is grown in localities where rainfall is sufficient for good returns.

The most critical stage of growth in relation to the moisture supply is at tasselling, and adequate moisture at this time is essential for good yields.

It is likely that one or two light supplemental irrigations in dry seasons would give economic increases in yields.

Potatoes.

Very little local information is available as to the water requirements of potatoes. Overseas literature indicates that the maximum yields of 8 tons per acre were obtained with a 20 in. application during the growing period, the rainfall in this period being 8 in.

This is in excess of the total water (irrigation plus rainfall) used in potato experiments conducted at Gatton Irrigation Research Station.

In the 1947 spring potato crop, a total of 11½ in. of irrigation was applied in addition to 5.3 in. of rainfall, the total yields being 9.95 tons per acre for spray and 9.91 tons for furrow application.

In spring 1948, a total of 3 in. of furrow irrigation plus 9.77 in. of rainfall was used, the plot yields averaging 7.73 tons per acre.

In Queensland, potatoes are grown under a wide variety of conditions, from the Atherton Tableland to the southern boundary of the State, so that no definite watering programme can be laid down. However, if soil moisture is deficient at planting time, a pre-planting irrigation is advised, rather than watering after planting.

Good soil moisture should be maintained, particularly at flowering, and frequent light applications spaced 10-14 days apart are required until the plants are approaching maturity, which is indicated by a dying off of the haulms. However, extra light irrigations may be needed at this stage as a protection against tuber moth.

The spray method is used almost solely in southern Queensland for irrigation of potato crops. In northern Queensland furrow irrigation is practised for the most part, spray irrigation being in use by a few potato growers only.

Irrigated Pastures.

Perennial or permanent irrigated pastures, containing a mixture of clovers, ryegrasses, cocksfoot and phalaris, which are extensively grown in the irrigation areas of southern States, have been introduced only recently into southern Queensland. Already, they have given definite indications of high productivity under border irrigation on the fertile alluvial soils in that area.

At the Gatton Irrigation Research Station, on a fertile alluvial clay soil the carrying capacity has been shown over a period of four years to be two beasts per acre. During this limited period, some assessment of water requirements of this type of pasture has been made for these conditions

Under Victorian conditions it is usual to apply surface irrigation at the rate of 24 in. per annum in the southern districts of the State, where mean annual rainfall is 30 in. per year. In the northern districts, where mean annual rainfall is 18 in., 30 in. of irrigation water are applied per annum. Thus the irrigation plus mean rainfall ranges from 48 in. to 54 in. of water per year. These figures probably represent the best rate of application.

For investigational purposes at Gatton, water application has aimed at maximum rather than best production of pastures and mean annual rainfall plus irrigation has exceeded 60 in. For example, in the 1950-51 season, rainfall was 38.01 in. and irrigation 25.8 in., thus giving a total of 63.81 in. In the 1951-52 season, 26.03 in., 36 in. and 62.03 in. are the corresponding figures.

In general, water usage for irrigated pastures in Victoria can be expected to be smaller. Rainfall in that State is mainly of winter incidence and intensity of fall is less; hence rainfall is more effective in supplying soil moisture. Moreover, evaporation is lower than in Queensland. Nevertheless, under the warmer climatic conditions of Queensland there is a longer growing season for the pastures and productivity appears to be higher. Production of pasture per unit of water applied, up to best production, can be expected to reach a high level, particularly as problems of management under local conditions are solved satisfactorily.

The frequency of irrigation of perennial pastures is governed largely by weather conditions. Usually 8-10 surface irrigations are required yearly, the irrigation interval being approximately one month from April to September in the absence of effective rainfall. During the hot, dry weather usually experienced in late November to January, the watering interval is reduced to 14 days, and it is possible that in heat-wave conditions in January an interval of 10-12 days would be required for maximum growth.

The amount of water applied at each irrigation varies widely according to the season of the year, soil moisture conditions at time of irrigation and density of vegetative cover or growth of pasture. During the cooler months, when growth and transpiration are lowered, depletion of moisture is confined to the first foot of soil, so a reduced application of water (2–2½ in.), can be applied following grazing of the pasture, a big head or flow of water being used.

When growth of pasture is rapid and transpiration loss is high during the summer months, reduction of soil moisture to a depth of 18 in. can occur rapidly, and it is necessary to apply water frequently at 12-14-day intervals to reduce the amount of water used for irrigation. The reason is that on the heavy clay soils at Gatton, drying is accompanied by deep cracking. If the soil is allowed to dry out unduly, the irrigation water will run down the cracks and penetrate below the zone of maximum root concentration. The result is that water is wasted for pasture production. Frequent applications are therefore necessary to prevent cracking and economise with water.

In a mixed pasture, the clovers show signs of water stress first. Clover roots have been traced to a depth of 4 ft. in a 3-year-old pasture, but the dense root system of clover is confined to the 0-12 in. zone, so reduction of clover stand will occur by withholding irrigation for protracted periods.

On sandy loam soils, more frequent irrigations will be required in summer if uniform high productivity of pastures is to be maintained.

It is emphasised again that the soil auger and the probe should be used before and after irrigations to obtain a guide to the frequency and amount of water applied for economic production of pasture.

Cotton.

Considerable local experience has been gained with cotton irrigation and results indicate that a considerable area of cotton could be profitably grown with supplemental irrigation. Cotton is eminently suited as a pioneer crop on a newly established irrigation area.

Cotton requires a good supply of subsoil moisture at planting time, and a pre-planting irrigation of 3-4 in. is advisable when subsoil moisture is depleted.

Planting is usually done after this initial irrigation and no further irrigations should be applied until the plants are "squaring" or producing flower buds, normally six weeks after planting. Excessive moisture during the pre-fruiting period tends to stimulate vegetative growth and delays crop formation. Deferring irrigation restricts early vegetative growth and causes a small, well-structured plant which makes an early crop of bolls.

After crop formation has commenced, irrigations should be timed to prevent checking of growth and loss of crop from shedding. Borings for field assessment of soil moisture will give an indication of the reserve of soil moisture in the soil, but the cotton plant itself shows easily recognizable symptoms of low soil moisture. As the supply of available soil moisture becomes depleted the leaves darken in colour and begin to droop and wilt. Flowering occurs towards the tops of the plants and the reddish colour which is normal only on the older woody portions of the stalks approaches and may even reach the terminal buds.

Irrigation should be applied when the flowers and reddish stem colour are about 9-10 in. from the top of the plant, otherwise cessation of plant growth and loss of crop will occur. Application of water when

the terminal shoot of the cotton plant is soft and sappy will induce rank plant growth, as plants in this condition indicate ample available soil water.

The quantity of water required at each irrigation is governed largely by the soil type, but the aim should be to replenish soil moisture to a depth of 2 ft. Usually a 3 in. application is required. The number of irrigations required is influenced by incidence of rainfall, but often 2 or 3 irrigations are required in addition to the pre-planting irrigation.

The critical period in the main cotton-growing areas is during the January heat-waves, when early planted crops are fruiting heavily. Stress conditions on many soil types can occur quickly under heat-wave conditions, and the need for timely irrigations should be anticipated so that the whole area can be irrigated before shedding occurs.

Cotton is irrigated mainly by the furrow method, but spray irrigation is also used for areas where soil type and topography are not suitable for furrow irrigation.

At the Biloela Regional Experiment Station, investigations with irrigated versus non-irrigated cotton have been carried out for a number of years and the results indicate clearly the value of growing cotton with supplemental irrigations during years of irregular rainfall.

The respective yields are set out in Table 1.

TABLE 1.

YIELDS OF SEED COTTON AT BILOELA.

Season.	Irrigated Cotton.		Rain Grown Cotton.	
	Time of Planting.	Yield per Acre.	Time of Planting.	Yield. per Acre.
		lb.		lb.
1940–41	18th Oct.	1,456	14th Nov.	420
1941–42	11th Oct.	1,721	14th Oct.	564
1942–43	3rd Oct.	1,137	9th Nov.	489
1943–44	14th Oct.	1,741	20th Oct.	653
1944–45	19th Oct. Replanted 5th Nov. after hail	1,200	29th Oct.	437
1945–46	12th Oct.	1,898	17th Oct.	813
1946–47	10th Oct.	1,434	10th Oct.	400
1947–48	4th Nov.	1,518	4th Nov.	529
1948–49	2nd Nov.	1,300	22nd Nov.	1,150
1949–50	19th Oct.	1,285	19th Nov.	1,328
1950–51	13th Oct.	1,372	13th Oct.	1,607
1951–52	12th Oct.	1,677	9th Oct.	696
	Mean yield seed cotton	1,478	Mean yield seed cotton	757

The yield figures from these trials show that a definite increase in yield was obtained in 10 out of 12 seasons for irrigated cotton. For two seasons only, when higher than average seasonal rainfall was received and soil moisture was adequate for crop production, did rain-grown cotton outyield irrigated cotton. The overall average for all seasons is definitely in favour of irrigated cotton.

Experiments with furrow versus spray irrigation of cotton have also been carried out at Biloela. The results of these experiments show that where land is graded to give a uniform flow of water, yields are similar with both methods. In the case of very sandy soils, however, spray irrigation gives a better distribution of water. On the other hand, less labour is required for furrow irrigation, as no changing of spray lines is necessary.

Tobacco.

The percentage of tobacco grown by irrigation in Queensland has steadily increased and at the present time the bulk of the crop comes from irrigated farms. An appreciable contribution to water supplies for irrigation purposes has been made by the provision of weirs and pumping stations, especially in North Queensland.

For the most part the furrow method is favoured, but in recent years spray irrigation has been used on newly settled tobacco farms in the Lower Burdekin and in the Ingham area. Sometimes a combination of both methods is applied. Spraying is practised for establishment in the field and for early growth. The furrow method is substituted when plant height is such that difficulty is experienced in shifting pipes without damaging the plants.

In most districts, because of dry winters and early springs, it is necessary to give an irrigation prior to planting and at least another light irrigation immediately after planting to wet and firm the soil around the roots of transplanted seedlings. A further irrigation may then be required in about seven days, when replanting of gaps in the stand is also made.

The frequency of later irrigations will vary with seasonal conditions, but as a general rule water should be applied at intervals of 7-10 days. As tobacco is grown in districts as far north as the Mareeba-Dimbulah area and as far south as the Texas-Inglewood area, no rigid rules for frequency of water application can be made.

For best quality, steady growth of the plants should be maintained. Thus soil moisture should not be allowed to dry out to a stage where growth is checked. The greatest water demand is during the period of maximum leaf growth.

Cultivation of tobacco usually ceases about six weeks after planting, because of the risk of damage to the rapidly growing plants. The surface of the soils used for tobacco tends to set hard, and when not broken absorption of water is reduced. In the case of furrow irrigation, it is advisable then to use a smaller flow over a longer period in order to promote effective penetration of irrigation water. It is important to have adequate soil moisture at this stage because the rapidly growing plants make a heavy demand on soil water.

Control of irrigation water is essential for successful tobacco cultivation, the aim being to wet the soil only to the depth of root penetration. Overwatering followed by heavy rain can cause water-logging and loss of crop. Drainage is therefore very important and a free outlet to drainage channels or areas of disposal should be maintained at all times.

Tobacco is grown on sandy loam soils with a high infiltration rate, but some heavier textured soils are used in the Texas-Inglewood area. It is necessary, therefore, to use relatively high furrow flows on moderate slopes. The use of small flows tends to cause overwatering at the top of the furrows, while large flows on steep slopes give poor lateral penetration of water and may cause serious erosion. A desirable grade for furrow irrigation is 3-6 in. per 100 ft. (2-4 in. per chain), the maximum grade allowable being 9 in. per 100 ft.

Furrow flow required varies with the soil type and slope, but for most tobacco soil types a flow of between 0.1 and 0.15 cusecs may be expected to give satisfactory penetration, using a furrow length of 3-5 chains.

Irrigation Practice in Queensland.

Part 8. Pumping Water for Irrigation.

By A. NAGLE, Irrigationist, Agriculture Branch.

UNITS OF MEASUREMENT OF WATER.

The units of measurement (volume) of water are the gallon, cubic foot, acre inch and acre foot. The term acre foot is commonly used in calculating storage capacities of dams and weirs. An acre inch represents the amount of water required to wet one acre to a depth of one inch and is approximately 22,600 gallons of water.

The unit of flow or discharge used is the cusec, which is equivalent to a cubic foot of water per second—that is, a volume of one cubic foot of water moving at a velocity of one lineal foot per second. A flow of one cusec continued for one hour delivers approximately one acre inch (that is, 22,600 gallons).

In irrigation community areas, water is measured at the farmers' intake channel, a metering device known as a Dethridge wheel being used. This operates satisfactorily with large flows but is not accurate for measurement of small flows of water.

The approximate delivery rate of small pumps can be obtained by directing the flow into a tank or receptacle of known volume. By timing with the second hand of a watch, the hourly delivery rate can be calculated. It is essential that the delivery or flow of water being used be known, as the amount of water applied to any border or field can then be determined.

For flows in streams a weir board is useful for obtaining measurement of flow, the height of crest of water flowing over a rectangular or V-notched opening being measured and the flow obtained by reference to conversion tables.

PUMPING WATER FOR IRRIGATION.

Power Unit.

Where individual pumping plants are to be used, careful consideration has to be given to the selection of a suitable power unit (either an engine or an electric motor) and a pump to deliver the required quantity of water. Due allowance has to be made for the static head or height to which the water has to be pumped, the friction head or resistance to flow of water through pipe line and fittings, and, if spray application is to be used, for spray head also. (This varies with the type of spray used, whether low, medium or high pressure).

Where electricity is available, an electric motor has certain advantages such as low installation and low maintenance costs. Usually costs of operation for an electric motor are approximately two-thirds the cost of fuel for a diesel engine operating the same load.

With an electric motor, power consumption does not vary greatly with changing loads, so the use of a motor in excess of the required horse power (after due allowance is made for overload conditions) is not economical. With a diesel engine the fuel used is proportionate to the load carried.

Where pumping is intermittent and a small area of land is to be irrigated, the pump may be driven by the farm tractor. This, however, usually means that cultural work has to be neglected when irrigation is in progress.

Type of Pump.

For pumping water for irrigation purposes from watercourses and shallow wells, the centrifugal pump is in general use. It is more suitable than the plunger or reciprocating type of pump, due to higher capacity and comparatively low purchase and installation costs. Maintenance charges are low and there is less liability for damage by sand or grit contained in the irrigation water.

For low lifts the single-stage centrifugal pump is used, and it operates efficiently with lifts up to 120 ft. Where water has to be pumped against a high lift, or where high-pressure spray plants are to be operated, the two-stage pump is necessary. Multi-stage pumps should not be used for low to moderate lifts as more power is required for driving these than single-stage pumps operating under similar conditions.

If the water supply for irrigation is from a borehole where the water is below effective suction lift of the centrifugal pump (that is, the suction lift is greater than 15 or 16 ft.), it is necessary to sink a shaft so that the pump can be placed close to the supply of water. With deep bores this is not practicable and the installation of a deep well turbine pump may be required.

Deep well turbine pumps have a series of impellers attached to a vertical shaft which is enclosed within the discharge pipe. The turbine pump can be lowered to any required depth, the bowls that contain the impellers being placed below operating water level.

Competent technical advice should be sought before installation of power unit and pump. The aim should be to obtain the power and pumping units which will operate most efficiently and economically for individual irrigation requirements.

[THIS SERIES IS NOW CONCLUDED.]

A SPECIAL RADIO SERVICE FOR FARMERS

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The COUNTRY HOUR, a special service for farmers, is broadcast DAILY from Monday to Friday through the National and Regional Stations from 12 to 1.

Storing Seed of Green Panic and Buffel Grass for Better Germination.

By W. J. WINCHESTER, Manager, Kairi Regional Experiment Station.

Methods for harvesting green panic grass seed were described in this journal for January 1954, and it was shown that seed quality improved with storage. A further study of the effect of storage on seed germination of green panic and buffel grass seed during a 5-year period has been completed and has yielded results of considerable interest to seedsmen and farmers.

Green Panic Grass.

When green panic (*Panicum maximum* var. *trichoglume*) first began to gain prominence as a grass for pasture improvement in the Central Burnett areas, farmers early discovered that seed of this grass seemed to germinate better if held for a period of 12 months before planting.

Experiences were also recorded by farmers who had obtained better germination of the grass in the season following planting (after the seed had lain in the ground for some months) than had occurred when it was originally sown.

TABLE 1.

GERMINATION OF GREEN PANIC.

Date Germinated	Sample *		Months Stored
	A	B	
	%	%	
May, 1949 ..	11	3	At harvest
August, 1949 ..	12	4	4
January, 1950	31	15	9
May, 1950 ..	46	10	13
August, 1950 ..	34	18	16
November, 1950	40	17	19
May, 1951 ..	46	8	25
November, 1951	41	11	31
August, 1952 ..	18	13	40
February, 1953	22	11	46
July, 1953 ..	10	9	51
March, 1954 ..	10	4	59

*A,—Harvested by hand stripping seed from head.

B,—Harvested by cutting heads with sickle then " sweating " in heaps for several days, then flailing to separate seed from panicles.

TABLE 2.

GERMINATION OF BUFFEL GRASS.

Date Germinated	Sample *			Months Stored
	A	B	C	
	%	%	%	At
March, 1949 ..	3	11	5	harvest
July, 1949 ..	67	43	32	4
October, 1949	61	47	42	7
January, 1950	79	49	41	10
May, 1950 ..	79	37	40	13
August, 1950 ..	79	47	41	16
November, 1950	77	52	43	19
May, 1951 ..	67	48	31	25
October, 1951	71	41	33	31
August, 1952 ..	83	46	30	41
February, 1953	86	40	35	47
July, 1953 ..	81	58	31	52
March, 1954 ..	44	21	30	60

*A,—Harvested by hand stripping.

B,—Harvested by cutting the heads off with a sickle, then dried in the sun, then flailed.

C,—Harvested by mowing, then sun-dried and flailed.

In order to verify whether these observations could be substantiated by germination tests, samples of seed were gathered in April 1949 by the then regular methods of harvesting, and with the co-operation of the Standards Branch, germination tests of these samples were carried out at frequent intervals for the ensuing five years.

The merits of a storage period of approximately 12 months is clearly shown in Table 1.

Reference to the table clearly demonstrates that green panic seed of good quality improves rapidly in germinability during its first 12 months of storage. It maintains high viability for some 18 months thereafter, and germinates reasonably well for a further 18 months, after which it shows marked deterioration.

Buffel Grass.

At the same time, samples of buffel grass (*Cenchrus ciliaris*) were gathered for similar testing. The results of the tests are as set out in Table 2.

With this species also, better germination can be expected if seed is not sown until the season following harvest. It retains good viability for some four years after harvesting, if stored under suitable conditions, but then begins to decline.

MAKING SILAGE FROM SUMMER GRASSES.

The advantages of storing the surplus summer growth from pastures in surface-type silos were explained to approximately 80 farmers who attended a recent field day on Mr. W. S. Bird's dairy farm at Upper Coomera. Visitors from other districts included men from Esk, Gatton, Boonah, Beaudesert, Murwillumbah, Currumbin and Moggill.

The field day has been arranged by the South Coast Pasture Improvement Discussion Group and the Department of Agriculture and Stock as a joint project.

Surface-type silos, either wedges or buns, can be constructed cheaply and quickly with a buckrake without any heavy outlay for equipment. They make possible the use of grass that otherwise would be wasted later in the year.

When the surplus pasture is stored as silage, it can be fed back to the stock in a succulent form during the dry weather that can be expected every year in late winter and spring. In addition, there is usually a re-growth of the mown pasture that will provide valuable grazing in the late autumn. If clover is present in the pasture, the mowing enables it to make vigorous growth during the winter, in contrast to its behaviour in unmown or ungrazed pastures, where the clover is suppressed by the long grass.

Farmers inspected paspalum ensilage in a wedge silo which was made with a buckrake last March as a Commonwealth Dairy Extension Grant demonstration. This stack was being fed back to Mr. Bird's dairy herd, which relished the fodder.

Mr. R. Hinz, of Upper Coomera, president of the South Coast Pasture Improvement Discussion Group, was chairman at the field day and introduced the speakers.

Mr. S. Marriott, the Department's Senior Agrostologist, discussed the value of conserving surplus summer-growing pastures on the farm; and Mr. A. Hegarty, Adviser in Agriculture, Brisbane, explained the construction of surface-type silos. Mr. J. G. Young, Husbandry Officer in the Cattle Husbandry Branch spoke on strip grazing.

Demonstrations of the use of buckrakes, sod seeders, fertilizer spreaders and electric fences were given by representatives of machinery firms.

Passion Fruits and Granadillas.

By J. McGREGOR WILLS (Senior Adviser in Horticulture) and S. E. STEPHENS (Horticulturist).

Several tropical and subtropical plants in the family *Passifloraceae* are grown commercially in Queensland for their distinctive fruits. The better known species are the passion fruits (purple, golden, hard-shelled passion fruits and the bell apple) and the granadillas.

PURPLE PASSION FRUIT.

The purple passion fruit (*Passiflora edulis,* fam. *Passifloraceae*) is a semi-woody climber which is native to Brazil and thrives in a wide range of climatic conditions. Commercial production of the crop in Queensland is, however, largely confined to southern districts.

The plant (Plate 1) is a short-term perennial which is heavily clothed with dark-green, deeply lobed leaves with elongate tendrils in their axils. Large and showy bisexual flowers are borne singly in the leaf axils on jointed stalks. The fully ripe fruit is purple in colour with a smooth, hard skin and an edible pulp containing many seeds. The pulp is an important ingredient in both fresh and canned fruit salads.

Plate 1.

Purple Passion Fruit. A young plantation at Mudgeeraba.

Climatic Conditions.

The vine thrives in the warm, humid coastal areas of central and southern Queensland and on the tropical highlands. Self-sown plants are commonly found along the edges of rain-forest clearings.

Under normal seasonal conditions, soil moisture in the coastal areas is adequate for the crop during most of the year with the exception of spring and early summer. If dry weather occurs during this period, partial defoliation and loss of fruit may be expected in areas where irrigation is not practicable.

In central and southern Queensland, frosts are rarely severe on the slopes of the coastal ranges and near the sea where the crop is usually grown. Although light frosts do little harm to the vines, the area selected for passion fruit should, where practicable, be free from frost.

Cropping Habit.

The period between planting and first fruiting depends chiefly on the time of planting and the vigour of the vines. Healthy plants established in spring may produce a few fruits within six months and bear a commercial crop in from 9 to 15 months. When autumn planting is practised, a light crop may be harvested in from 9 to 12 months but the first full crop matures 12 months later. In some localities, two crops are borne each year—a main summer crop and a secondary winter crop. Blossoming for the summer crop takes place during August, September and October and for the winter crop during February and March. The period from fruit setting to harvesting is about 10 weeks. Marketing of the summer crop commences in October and may extend to January, the heaviest pickings being made in November and December. The winter crop is usually harvested in May and June.

Occasionally intermediate off-season crops are obtained, the most important of these being harvested from February to March.

Selection of Site.

Factors which should be considered in selecting a site for a passion fruit plantation are aspect, elevation, shelter, soil, drainage and accessibility.

In southern Queensland the aspect should be from east to north, open to the morning sun and backed by rising ground or dense natural timber to protect the area from westerly or southerly winds. Such slopes are naturally warm. In the tropics and close to the sea, aspect is of secondary importance but the vines require some protection from persistent south-east trade winds.

The passion vine grows satisfactorily in fertile, well-drained loams. Stagnant water at the roots is, however, fatal. On virgin rain-forest soils, the vines tend to produce excessive vegetative growth which must be thinned out if fungus diseases such as brown spot are to be kept in check. On the less fertile soils the vines seldom carry excessive foliage and usually crop well. Soils which are poor in organic matter dry out rather quickly, but this defect can be rectified by growing cover crops during the summer and turning them in during the autumn and winter months.

Land Preparation and Planting.

The land should be well cultivated before planting so that the young vines can establish themselves rapidly and develop a good root system. The initial ploughing should be deep and subsequent culti-

vation is then designed to produce a good tilth. On rocky or steep land which cannot be ploughed, the soil may be broken up with mattocks or steel-pronged forks. Preparation should begin about three months before planting so that any rain which falls will be conserved for the use of the crop.

Coastal soils are frequently acid, and if the pH of the land is less than 5·5, from 1 to 2 tons per acre of lime or dolomite should be applied prior to planting.

Usually 8-10 ft. is allowed between the trellised rows and 8-16 ft. between plants in the row. The row spacing is determined mainly by the equipment used for operations such as cultivation and spraying, but the plant spacing varies with the fertility of the land; the better the land, the greater the distance between plants. When the vines are planted too close in the row, the foliage becomes very dense in the second year and it may then be necessary to remove every alternate vine if the area is to be retained for a longer period.

Trellising.

The purple passion vine is grown commercially on a trellis. The trellises are run in a north-south direction wherever possible so that the sunlight will be evenly distributed over the vines. On hillside plantations, it is not always practicable to observe this rule and the vines are then planted across the slope.

In commercial vineyards, trellises are mainly of two types, the vertical and the horizontal. In both cases, the hardwood posts are 7½ ft. x 7 in. x 4 in. in dimensions. They should be set 18 in. in the ground. The strainer posts at the end of each row are of heavier timber and may be either round or split; they should be set 2 ft. 6 in. in the ground and well stayed. One strainer to every 80 yards of trellis will prove sufficient in most locations.

Plate 2.

Vertical Trellis, Suitable for Passion Fruit.

In the vertical trellis (Plate 2), holes are bored in the posts to take the wires. One is close to the top of the post, a second is 12 inches lower and the third may be 15 inches or so nearer the ground.

In the horizontal type of trellis (Plate 3), two wires run about 6 ft. above ground level at a distance of about 2 ft. from each other. They are kept in position by 2 x 2 in. cross members, each of which is 2 ft. long and fastened to the top of a post. The wires pass through holes or fit into grooves at the ends of the cross member. Single-wire trellises are used in some areas.

Plate 3.

Horizontal Trellis. The type illustrated has three overhead wires but two-wire types are more widely used.

The wires must be strained to prevent heavily laden lateral shoots from sagging to the ground. Small cast-iron rollers are excellent for this purpose, being easily operated and always in position. Various gauges of wire are used in the trellis but No. 8 galvanised iron wire is popular. Should the wires sag during the cropping season, stakes may be erected between the posts to support them until the fruit has been harvested. The wires may then be tightened when pruning is completed.

Propagation.

The passion vine is usually propagated from seed and growers normally obtain supplies from fully matured fruits of healthy, vigorous vines. These fruits are cut in half and the contents placed in a jar of water for a few days until the seed separates from the pulp. The seeds are then repeatedly washed and finally dried.

For a spring (September-October) planting, seed from the previous summer crop should be sown in beds which are reasonably well isolated from established passion vines either cultivated or wild. The seeds are sown thinly about $\frac{1}{2}$ in. deep in shallow drills spaced some 9 in. apart,

the soil being then levelled-off, pressed and covered with a light mulch. The seedlings appear above ground in about four to six weeks, and as they develop they are thinned out to about 4 in. apart. Lanky, weak plants result from any crowding in the seedbed.

Sometimes the crop is sown directly in the field, several seeds being planted in each vine position under the trellis. The most vigorous seedling in each group is retained for the final crop. Germination in field sowings is often poor and the seedlings require a great deal of attention until they are well established.

Transplanting.

Seedlings raised in seedbeds are usually transplanted between September and February. March-August plantings are generally undesirable as growth may be checked by cool temperatures in winter and lack of soil moisture in spring.

Plants which are about 9 in. in height may be safely transplanted. If the seedlings are excessively tall, the top growth should be cut back and the larger roots should be severed with a spade about a fortnight before they are to be set out in the field. Dull, cool or moist weather should be chosen for transplanting, but care is necessary to ensure that the seedlings do not dry out before they are set in the plantation.

Large holes about 12 in. in diameter and 12 in. deep are dug in each vine position midway between the trellised posts. One seedling is placed in each hole, the roots being spread evenly in a downward direction before the hole itself is filled with surface soil. Plants should be set at the same depth as in the nursery and watered immediately afterwards.

Training the Vine.

Within a few weeks after transplanting, numerous lateral shoots appear at the crown of the plant and many of them outgrow the original terminal. When they attain a length of from 12 to 18 in., one or two of the more vigorous are selected to form the framework of the vine and all other shoots are carefully cut away. A light stake is driven into the ground alongside each seedling and fastened firmly at the top to the trellis wire; this supports the vine until it reaches the wire and can support itself. The young vine is tied to the stake at intervals of about 12 in. in order to prevent wind damage. If the tie binds a leaf stalk and tendril—not the actual stem—to the stake, there is no necessity for removing the ties later on. Stakes may be replaced by a V string joining the trellis wires to a peg at the base of each vine; in this case, ties are unnecessary as the leaders support themselves when wrapped round the string.

All side branches arising from the stem between the ground and the wires should be snapped off when they appear and axillary buds may be cut out at the same time to prevent re-growth in these positions. In multiple-stemmed vines, a damaged stem can be replaced by a lateral shoot from another. Vines trained to a single main stem take longer to cover the trellis than multiple-stem vines but are easier to control as the vegetative growth is less dense. On sloping land, where trellises have been erected up and down the slope and not on the contour, each leader is trained uphill on its own wire.

On the Vertical Trellis.

In single-stem vines grown on a vertical trellis, the tip is pinched out when the leader reaches the bottom wire. The stem will then throw out side branches near the top. Three of four of these branches which are growing close to each other are selected and the others removed. Two of the branches are trained in opposite directions along the bottom wire. A third may be carried up to the top wire, where the tip is pinched out to promote development of further side branches which can be trained in opposite directions along the top wire. Sometimes two branches formed after the first pinching are carried to the top wire and trained in opposite directions.

When two main stems are allowed to grow from the ground, the tip of one should be pinched out when it reaches the bottom wire and two laterals are later trained in opposite directions along it. The second stem is taken up to the top wire, where it is similarly trained.

On the Horizontal Trellis.

With the horizontal trellis, the tip of a single-stem vine may be pinched out when it reaches the wires and four of the laterals which develop are trained in opposite directions along the two wires. In two-stem vines, the tips are pinched out near the wires and each wire takes two of the laterals developed from one of the stems.

The part of the vine which grows along the wire is termed a leader. Leaders should be given long gradual turns around the wires and loosely tied at intervals. All turns must be made in the same direction to prevent sagging. Lateral growth can be accelerated by nipping out the terminal of the leader as it approaches the neighbouring vine. The laterals should be encouraged to grow straight down; if this is done the vines remain open and spraying, harvesting and pruning operations are simplified.

Plantation Management.

The passion vine is a comparatively shallow-rooted plant and after the crop is established, cultivation should be kept to the minimum; it is required only for the control of weeds and to prevent caking of the surface soil. Care is essential when weeds are being chipped around the vines, for injury to the stem and main roots is often followed by an outbreak of a disease known as base rot. It is preferable to pull all weeds in the vicinity of the stem by hand.

Green Manuring.

A green manure crop may be planted between the trellises after storm rains in early summer to provide a ground cover for the wet season. Poona pea and other types of cowpea are suitable for the purpose. On soils where difficulty is experienced in getting Poona pea to grow, pigeon pea will generally provide a good first crop if sown in spring. In either case, the green manure crop can be mowed in autumn or disced in July.

Green manure crops planted subsequent to the first year's growth of the vines should be confined to a 4 ft. strip along the avenue.

When passion fruit are grown on virgin land, a green manure in the standing crop is generaly desirable. If, however, some vines have collapsed from root diseases, discing in the green manure may tend to

spread the disease. Under these circumstances, it is better to mow the cover crop and leave the residues on the surface of the ground.

Fertilizing.

The passion vine requires a plentiful supply of plant food. On fertile virgin land, no fertilizer will be needed for the first year or two after planting. On land which has been previously cropped and in all plantations which are more than two years old, a fertilizer programme is normally essential. The amounts required will depend to some extent on the vigour of the vines; rates of application of 4 lb. per vine per annum are commonly used. The fertilizer is applied in two equal dressings, the first in the July-August period and the second in December-January. A 5-13-5 or similar mixture which is high in phosphoric acid is satisfactory in commercial practice. If necessary, the above fertilizer schedule may be supplemented by a dressing of sulphate of ammonia in spring at the rate of 1 lb. per vine.

The fertilizer should be placed in a band round, but not close to, the base of the vine. Once the vines have filled the trellis, broadcast applications are permissible.

Irrigation.

If the crop is irrigated, the vines can be kept growing and blossoming almost throughout the year. The plants can therefore be pruned whenever convenient and forced into new growth for the production of another crop. Overhead spray systems are generally used in areas where irrigation is practised, either because the water supplies are limited or the topography of the land is not well suited to furrow irrigation.

Plate 4.

Passion Fruit Vine After the Winter Pruning.

Pruning.

Pruning serves a variety of purposes in the passion vine plantation; dead wood is removed, the vines are opened-up, the production of fruit-bearing laterals is increased and the harvesting period is brought under control.

Passion vines should be heavily pruned (Plate 4) once each year, usually in July or August after the winter crop has been harvested.

Under ordinary circumstances, heavy pruning in winter produces a big summer crop and a somewhat smaller winter crop. However, by shortening back the flowering laterals in October and sacrificing portion of the summer crop, the size of the intermediate crop can be increased if weather conditions are favourable. Similarly, by shortening the flowering laterals in February a late winter crop can be secured.

In the winter pruning, all laterals are severed about 12 in. below the trellis wires with the aid of a reaping hook or cane knife. By this means, the bulk of the current year's growth is removed and it is possible to get a clear view of the framework of the vine. Dead and unthrifty wood is then cut away with secateurs and the stronger laterals are shortened to about 12 in. Each of these laterals will have two or three buds to provide new canes for the following crop.

Replanting.

The commercial life of a healthy passion vine is about four years. Many plantations are, however, short-lived owing to the inroads of disease, and some provision must therefore be made for continuity of production on the farm. In a well-managed plantation, new vines should be coming into bearing either every year or every alternate year. On most properties, this involves some form of crop rotation and a planting programme in which individual crops are some distance from each other or separated by tall vegetation to lessen the risk of disease infection. This risk may be reduced to some extent by the prompt destruction of old vines which no longer bear commercial crops of fruit.

Under a rotational system of crop management, additional trellises are necessary but the expense can be offset by the returns from vegetable and other crops grown in trellised areas which are being spelled from passion fruit.

Harvesting and Packing.

The crop should be gathered daily in the early morning or the late evening when the fruit is cool. All fruit on the ground is picked up first, as even a short period of exposure to the sun may cause severe scalding and make the fruit unsuitable for sale.

Good colour is essential and during cool weather the fruit should be picked when the rind is a deep purple. In the summer, the fruit is gathered when from half to three-quarters of the surface skin has a purplish tinge. Fruit which is harvested in wet weather should be allowed to dry before it is packed.

All fruits should be carefully picked to prevent the skin being damaged. By grasping it in the hand with the thumb and forefinger on the fruit stalk and pressing forward with the thumb and backward with the forefinger, the mature fruit is easily detached. Fruit should be placed—not dropped—into picking boxes or tins which are kept under shade and shelter from strong winds.

Passion fruit consigned to the fresh fruit market is packed in half-bushel dump cases (Plate 5). Fruit sent to the factory may be forwarded in sugar bags or similar containers.

On well-cared for vines a return of 200 half-bushel cases per acre can be expected from the first main summer crop.

Plate 5.

Passion Fruit Packed for the Fresh Fruit Market.

GOLDEN PASSION FRUIT.

Although the fruit of the golden passion fruit (*P. edulis* var. *flavicarpa*) differs considerably from that of the purple passion fruit, the vine is similar. It is, however, more vigorous and thrives better under tropical conditions. The tendrils, leaf stems and primary veins are purplish and the same colour character is conspicuous on the basal ends of the rays constituting the corona. The fruits are usually almost spherical. When immature, the skin is mottled with white spots, but the ripe fruit is a pale, golden-yellow colour.

The golden passion fruit flowers profusely but is unreliable in its cropping habits when grown on a trellis of the normal type and hand pollination is nearly always necessary to ensure fruit setting. Hand pollination is most effective when carried out between 2 p.m. and 4 p.m. Vines which are allowed to grow naturally over tall trees usually set fruit reasonably well.

Golden passion fruit contains a larger amount of seed pulp than the purple passion fruit and the pulp is both more aromatic and more acid. Hybrids between the purple passion fruit and the golden passion fruit occur in North Queensland. The best of these have large oval fruits with a claret-coloured skin and the pulp is intermediate in flavour and aroma to that of the two parents.

Cultural practices for this variety are the same as for the purple passion fruit.

THE BELL APPLE.

The bell apple (*P. laurifolia*) is indigenous to Brazil and the West Indies and is fairly commonly cultivated in Malaya, from which country it has been introduced into Queensland. It is often known as the Singapore passion fruit.

Unlike most of the Passifloras, the leaves are laurel-like, dark-green and closely placed on the stems so that the vine is densely foliaged. The flowers are borne in profusion and are both handsome and fragrant. The fruit is ellipsoidal, up to 3 in. long, orange-yellow in colour and partly enveloped by three large green bracts. The skin is soft and spongy and encloses a fragrant seed pulp with a pear-like flavour.

The plant grows readily from seed or cuttings and thrives in most fertile soils. However, it is strictly tropical in its climatic requirements and is grown successfully only in North Queensland.

Fruit setting is unreliable but is generally best on a horizontal trellis of the type used for granadillas. Hand pollination will ensure a good fruit set on some vines but is ineffective on others. Flowering occurs during the greater part of the year if moisture is abundant and humidity is high.

HARD-SHELLED PASSION FRUIT.

The hard-shelled passion fruit (*P. maliformis*) is a native of tropical America and the West Indies. In many English-speaking countries overseas it is commonly known as the sweet calabash.

The vine is slender and relatively small with entire ovate leaves up to about 6 in. long. The attractively coloured flowers are similar to those of other passion fruit but the front of the calyx lobes is dotted with reddish-brown. The flowers are also enclosed in three large cream-coloured bracts which persist and envelop the fruit. The fruit is small with a very hard shell and the pulp is inferior to that of the purple passion fruit.

The hard-shelled passion fruit has little value as a commercial fruit. However, it is hardy and apparently immune to the attack of certain pests and diseases that cause much loss in some other Passifloras.

GRANADILLA.

The small-fruited granadilla (*P. quadrangularis*) and the large-fruited granadilla (*P. quadrangularis* var. *macrocarpa*), both of which grow well in North Queensland, are native to tropical America. They are similar in growth, flowering and fruiting habits but the fruit of the small-fruited variety is 6-8 in. long while that of the large variety grows up to 12 in. in length. The small-fruited type contains relatively more seed pulp than the variety *macrocarpa*, but the latter has a thicker and better flavoured flesh.

The granadilla is essentially a tropical plant, and is particularly susceptible to damage by frost. High temperatures accompanied by high humidity are necessary for fruiting; under dry atmospheric conditions the flowers produce little or no pollen and the fruit set is consequently poor.

A fertile soil with good moisture-holding capacity and free drainage is essential for good growth of the plant. Silty alluvial soils are most suited to the crop but any well-drained loam may be planted in tropical areas.

The Trellis.

The vine is supported on a horizontal trellis known as the granadilla shed (Plate 6). This special structure is 7 ft. high with the posts set on the square at 10 x 10 ft. spacings. The tops of the posts are tied with wooden rails which in turn support plain wires spaced at intervals of about 18 in. It is usual to build the shed in several sections. The granadilla shed must be solidly constructed with well-stayed end posts, for it has to support a considerable weight.

Plate 6.
Granadilla Shed.

Propagation and Training.

The granadilla may be grown from seed or from cuttings. Seed must be quite fresh as it retains its viability for only a short period. Germination takes place in 14–21 days and the seedlings can be set out in the trellis when they are 6–12 in. in height.

During the summer wet season, cuttings strike readily. They should be cut in lengths of 15–24 in. from vigorous lateral branches of the vine. After the leaves on the lower two-thirds of the cutting are removed, the cutting is planted in well-prepared soil at the foot of a trellis post with about one-third of its length out of the ground. Two cuttings are usually planted alongside each trellis post; if both grow, the less vigorous is removed. When plants are established at the base of each supporting post of the granadilla shed, the vines quickly cover the trellis. After the first fruiting, the shed may become overcrowded and it is then necessary to remove every second vine by cutting it at ground level.

Young plants make very rapid progress if a support is provided for the climbing vine. A bamboo top with side shoots intact makes an excellent support with ample contact points for the tendrils of the vine.

Early training of the granadilla plant requires the removal of side shoots as they develop and also any suckers arising from the stem near ground level. These shoots break off easily when they are only a few inches long. The plant should be trained to a single stem until it

Plate 7.
Granadilla Fruit

reaches the overhead trellis. When this stage has been reached, the terminal bud can be removed and two main arms allowed to develop. These main arms are so spaced on the wires that the shed will be evenly covered. Laterals will develop at intervals along the main arms and spread across the adjoining wires so that the whole plant receives adequate support.

Fertilizers.

Fertilizers containing organic nitrogen are considered most suitable for the granadilla vine. A complete mixture with a 7-10-10 or similar formula should give good results if two dressings are made at a rate of 1 lb. to 2 lb. per vine, the first in spring and the other immediately after the summer wet season. If the vines lack vigor in early summer, a supplementary dressing of sulphate of ammonia at the rate of ½ lb. per vine can be applied at that time. Adequate supplies of organic matter should be maintained in the soil by using a surface mulch at regular intervals.

Fruiting and Harvesting.

The fruit is set on new wood and the crop is normally less seasonal than that of the purple passion fruit. Fruit in all stages of development can usually be found on a vine at any season of the year. There are, however, two main crops, which mature in autumn and early spring. The small-fruited granadilla sets freely by natural pollination but the large-fruited variety usually requires hand pollination to secure a good crop. The best results are obtained by self pollinating the flowers within 4–6 hours after the buds open.

The period from flowering to fruit maturity is approximately 11 weeks. Maturity (Plate 7) is indicated by a change in colour from green to yellow at the apex of the fruit. As ripening progresses further, the whole skin changes to a bronze-yellow shade and the flesh becomes soft. For market purposes, the fruit should be harvested when the first change of colour is observed. The fruit can be clipped from the vine with secateurs or spun round several times until the stem breaks. Baskets or crates padded with woodwool should be used when harvesting the fruit, and any risk of damage in transit to market can be reduced by packing in woodwool.

Yield from a small-fruited granadilla vine in full crop is in the vicinity of six to ten dozen fruit per year, but from the large-fruited variety it is seldom more than two or three dozen per year.

COUNTRY BREAKFAST SESSIONS.

The Rural Broadcasts Section of the A.B.C. is now providing regular breakfast sessions of interest to rural people from 4QY, 4AT, 4QB, 4GM and 4QS, Monday to Friday from 7 to 7.15.

Harry Greaves, stationed at Cairns, handles the northern programme, and Trevor Stockley conducts the southern programme from Toowoomba.

A Seed Germination Count in Progress at the Department's Seed Testing Station.

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

The Honey Flora of South-eastern Queensland.

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page* 154 *of the September issue.*)

Swamp Messmate.

Botanical Name.—Eucalyptus robusta Sm.

Other Common Name.—Swamp mahogany, a name more commonly used in Queensland for another tree (*Tristania suaveolens*).

Plate 95.

Swamp Messmate (Eucalyptus robusta). Branchlet with leaves, buds and flowers. Inset shows seed-capsules.

Other Botanical Name.—Eucalyptus multiflora Poir.

Distinguishing Features.—A tree with a rough, somewhat stringy bark, shining dark green leaves paler and duller underneath, comparatively long buds with a tapering lid, and cylindrical seed-capsules (Plates 95–96.)

Plate 96.

Swamp Messmate (Eucalyptus robusta). Beerwah.

Description.—This is a tree up to about 50 ft. high with grey, somewhat fibrous bark and often a fairly dense crown. The leaves are spreading, dark shining green on the upper surface, paler and not shining underneath, mostly 3–6 in. long, 2–4½ times as long as wide. The flowers are white in colour, produced in flat-stalked bunches towards the end of the twigs, and about ¾ in. wide when fully out. The buds are about ¾ in. long on short stalks and about ¼–⅜in. wide. The lid is about as long as and slightly wider than the lower part of the bud, and it tapers to a blunt point. The seed-capsule is about ⅜–½ in. long and ¼–⅜ in. wide; it is cylindrical in shape but tapers into a short stalk.

Distribution.—Moreton and Wide Bay Districts, in lowlying sandy forest country, but not common; also in the Port Curtis District and in coastal New South Wales.

Usual Flowering Time.—June to July.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Minor.

General Remarks.—Swamp messmate flowers often in association with paper-barked tea-trees and the honey is usually masked in this natural blend. It blossoms regularly and the reliability of supply rather than the quantity of pollen and nectar is an important feature. During a winter in which the usually more prolific paper-barked tea-trees fail to produce, this tree is particularly helpful in providing stores for colonies.

The honey is pleasantly flavoured and has reasonable density. Its granulating qualities are not known.

White Clover.

Botanical Name.—*Trifolium repens* L.

Other Common Name.—Dutch Clover.

Distinguishing Features.—A soft, low-growing, creeping plant with leaflets in 3's on each stalk and rounded clusters of white or pinkish small pea-like flowers (Plates 97–98).

Plate 97.

White Clover (Trifolium repens). Leaves and head of flowers.

Plate 98.

White Clover (Trifolium repens). Tingalpa.

Description.—This is a perennial herbaceous plant with slender creeping stems forming rich-green patches close to the ground. Each leaf consists of three leaflets clustered at the end of a stalk. The leaflets are rounded, about $\frac{1}{2}$–$\frac{3}{4}$ in. long and wide, with finely toothed edges. The flowers are white or tinged with pink and produced in rounded clusters of 40–80; they are shaped like those of a pea but are only about $\frac{3}{8}$ in. long. The pod is small, mostly covered by the remains of the flower.

Distribution.—Widely spread in south-eastern Queensland and many other parts of Australia, chiefly towards the south, in pastures and lawns and along roadsides. It is a native of Europe.

Usual Flowering Time.—Late winter, spring and early summer.

Colour of Honey.—Water white.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.

General.—White clover requires good rains in order to bloom prolifically, and under these conditions it is a useful nectar and pollen supply. Although not utilized to any appreciable extent by Queensland beekeepers it helps to build up colonies permanently situated in the Logan and Maleny districts and occasionally a small honey surplus is obtained.

This first grade honey has weak density and a characteristic mild sweet flavour; it granulates quickly with a transparent, slightly coarse grain.

Flat Weed.

Botanical Name.—Hypochoeris radicata L.

Other Common Name.—Dandelion.

Distinguishing Features.—A plant with milky juice, numerous variously lobed leaves nearly all pressed flat to the ground and a few nearly erect, leafless stems ending in bright yellow "flowers" about 1 in. across (Plate 99).

Plate 99.

Flat Weed (Hypochoeris radicata). Plant showing leaves and flowers. Wynnum South.

Description.—This is a low growing plant with milky juice and a stout taproot. The leaves are clustered from the top of the taproot and all or nearly all are pressed close to the ground; they are about 3–6in. long, mostly less than 1 in. wide, hairy, and partly cut into several lobes of irregular size and shape. The flower-stalks arise from the middle of the cluster of leaves; they are up to about 18 in. high, sometimes branched, with a "flower" at the end. Each "flower" is yellow, about 1 in. wide, and is really a cluster of small flowers each with, apparently, one toothed petal. The "seeds" have an umbrella-like arrangement of fine white hairs—the well-known "thistle-down."

Distribution.—This plant is a native of Europe and is naturalized over a large part of Australia. It is common in south-eastern Queensland among grass, especially where there is little or no timber. It is a common weed of lawns.

Usual Flowering Time.—Late winter, spring and early summer.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Major.

General.—Under wet conditions flowering may also occur during autumn. The large quantity of bright yellow pollen and the small amount of nectar obtained stimulate brood-rearing.

As honey is not produced in sufficient quantity to extract, its trade characteristics are not known. In the comb it has a yellowish tinge.

[TO BE CONTINUED.]

WEED CONTROL IN MAIZE CROPS.

For weed control in maize crops, pre-emergence spraying with hormone weed-killers has shown considerable promise, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) stated recently.

These results, he said, had been obtained by officers of his Department, who had now assessed the value of the satisfactory weed control obtained last season by using pre-emergence sprays in experimental plots of maize.

A series of trials under the supervision of the Department's Senior Agronomist (Mr. V. J. Wagner) was laid down at Mareeba last maize season by field officers of the Department.

In the trials three types of the hormone weed-killer 2,4-D were used at three different rates of application. There was almost complete prevention of germination of weeds in all plots during the first three weeks after spraying, but in the following three weeks scattered weed seedlings appeared in the plots which had received the lowest rates of application.

It was noted that six weeks after spraying no more weed seedlings germinated. This was considered to be due to a combination of the residual effect of the spray and shading by the growing maize plants.

A further development of pre-emergence spraying to receive consideration because of its economic importance is planting and spraying in the one operation, which removes the need to cover the ground a second time. This may assist considerably in effecting the adoption of the use of pre-emergence sprays by maize growers, as the return per acre from maize is lower than that from some other crops, such as peanuts.

Plans are in hand to carry out further trials next season to check and amplify the results already obtained.

The Gladiolus Thrips.

By B. R CHAMP, Assistant Entomologist.

The gladiolus thrips (*Taeniothrips simplex* (Mor.)), is the most serious pest of gladiolus in Queensland, and although there may be apparent varietal resistance at times, most plantings require protection from this pest. Related plants are also subject to attack.

Thrips attack on the leaf and corm usually results in a characteristic silvering (Plates 1 and 2), and severe injury is followed by "rusting." Leaf damage is seldom of primary importance but the destruction of stored corm rootlets and buds may affect germination. Feeding by adults and nymphs on the developing spike causes distortion and malformation (Plate 3). Slight injury to blooms appears as unsightly irregular whitish areas (Plate 4).

The dark-brown adult female (Plate 5), which has two pairs of delicate fringed wings, is about one-fifteenth of an inch in length; the male is slightly smaller. The minute kidney-shaped eggs are inserted into the plant tissue. The two nymphal stages are light yellow, and on the growing plants are present within the leaf sheaths and flower buds. These and the adults feed by chewing the surface tissues, but the adults usually feed in the open. The pupae are to be found on the plants and in the soil. In summer, the complete life cycle period may be slightly less than 10 days.

CONTROL.

Adequate control can be obtained with a range of insecticides, but it is essential that infestations should not become established.

In Storage.

Stored corms should be dusted with 5% DDT or 4% BHC (0.5% gamma

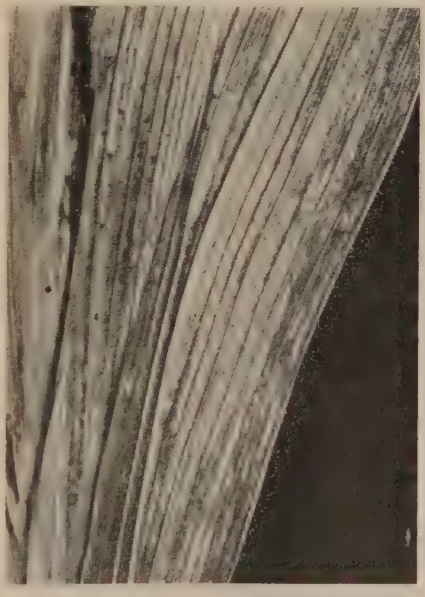

Plate 1.

Silvering of Leaf Due to Gladiolus Thrips.

Plate 2.
Healthy and Affected Corms.

Plate 3.
Normal Spike and Spike Showing Effects of Thrips Infestation.

Plate 4.
Whitish Areas on Affected Blooms.

isomer) after treatment which may be required for disease control.

In the Field and Garden.

Spraying.—Recommended sprays are 0.1 % DDT, 0.05% dieldrin, and BHC 0.03% gamma isomer. Spraying should commence when the plants are 6-9 in. high, and should be continued until flowering. With DDT or dieldrin, treatments every 7-10 days may be necessary, but BHC would be required more frequently. DDT also controls the corm ear worm (*Heliothis armigera* (Hb.) and the cluster grub (*Prodenia litura* (L.)), which are sometimes pests of gladioli. Dieldrin is effective against only one of these caterpillars (the cluster grub).

Corm Soaking and Soil Treatment.—When corms are soaked in a 0.5% Systox solution overnight prior to planting, such treatment confers immunity from thrips attack for at least five weeks after planting.

Just before the flowers emerge from the throats the root areas should be watered with a 0.05% Systox solution at the rate of 2 gallons per square yard. On light sandy soils a smaller dosage is desirable. A thorough watering should follow this soil treatment.

Plate 5.
Adult Female Thrips Much Enlarged.

Corm Soaking and Spraying.—If desired for reasons of economy, corm soaking may be supplemented by a DDT or dieldrin spray schedule commencing five weeks after planting, instead of soil treatment with Systox.

Warning.

Dieldrin and Systox are poisonous and may be absorbed through the skin. Care should also be taken to avoid inhaling these insecticides. Splashes of the concentrates should be washed off immediately with soap and water, and clothes which are splashed or wetted should be changed and not worn again until they have been washed.

Brucellosis-Tested Swine Herds.

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found A semi-annual or annual re-test of the herd, as determined by the Director, is required.

TESTED HERDS (As at 20th September, 1954).

Berkshire.

S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
R. G. Koplick, "Melan Terez" Stud, Rochedale
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
E. Pukallus, "Plainby" Stud, Crow's Nest
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington Stud, Underwood Road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, "Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Bardell," Goovigen
R. E. Paulsen, "Crest" Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, "Hartley Grange" Stud, 684 Logan road, Greenslopes
W. F. Ruhle, "Felbar" Stud, Kalbar
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. J. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, via Rosewood

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. G. Koplick "Melan Terez" Stud, Rochedale
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
M. D. Power, "Ballinasloe" Stud, Swan Creek, via Warwick
H. L. Larsen, "Oakway," Kingaroy
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
Mrs. I. G. Utting, "White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum Kingaroy
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai" Stud, Clifton
F. K. Wright, Narangba, N. C. Line
O. B. Vidler Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub *via* Beenleigh
R. G. Koplick, "Melan Terez" Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
P. V. Campbell, "Lawn Hill" Stud, Lamington
H. J. Armstrong, Alhambra," Crowthorpe, Murgon
Q.A.H.S. and College, Lawes

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
D. Kay and P. Hunting, "Kazan" Stud, Goodna
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
A. Curd, "Kilrock" Stud, Box 35, Jandowae
F. K. Wright, Narangba, N. C. Line
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
A. H. Groves, "Kinvara" Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea" Stud, Murgon
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart "Springbrook," Pie Creek Rd., Gympie
W. R. Dean, "Trelawn," Tandur, via Gympie

British Large Black.

W. F. Ruhle, "Felbar" Stud, Kalbar
H. W. Naumann, "Parkdale" Stud, Kalbar

Can We Grow More Fat Lambs?

By B. D. McFARLANE, Assistant Adviser in Sheep and Wool.

Australia could be short of meat within the next few years. While the cattle industry is striving to increase production, any results it obtains will, of necessity, be slow in improving the overall position. On the other hand, fat lamb production could be increased quickly. Growing more fat lambs would mean more meat of a different kind for home consumption and more beef for export.

Queensland presents tremendous scope for increased lamb production. Besides the Darling Downs, the sub-coastal agricultural plain can grow more fat lambs.

Fat lamb production is a specialised form of sheep husbandry from which both meat and wool are produced. This gives producers two sources from which to draw their income.

The aim of all fat lamb breeders should be to produce a uniform drop of early-maturing lambs. These are usually a short, low-set, "dumpy type," with meat right down their legs, and having a U-shaped twist. Their shoulders are thick, ribs well sprung, backs are broad and covered with thick flesh which is not over-fat. They should be marketed off their mothers as suckers at 3½–4 months of age and dress out from 28 to 36 lb. The short blocky type of joint they produce is the one most favoured by the housewife.

A good skin value is desired but is not always obtainable.

WHAT IS THE BEST TYPE OF MOTHER TO USE?

The desired type of ewe for fat lamb mothers and the type always available are by no means the same! British Breed and Corriedale ewes are often difficult to buy in Queensland and may be expensive.

If you decide to buy a line of ewes as mothers, select an even flock of large-framed, roomy ewes with sound mouths and sound udders capable of producing large quantities of milk. British longwool or Corriedale Merino crosses are the most suitable mothers. These ewes are large-framed, good milk producers, excellent mothers and have a fair wool covering. Queensland has more Merinos than crossbreds. They form a ready supply of relatively cheap ewes with which to join the longwool rams. The ewe progeny makes good fat lamb mothers. The Border Leicester, Corriedale or Romney Marsh by Merino cross have proved very suitable fat lamb mothers.

One of the biggest considerations in fat lamb raising is early maturity of the lamb. The parents that produce these lambs are the best to use. This means care has to be given to the selection of rams, too.

WHAT RAMS SIRE THE BEST LAMBS?

Dorset Horn, Dorset Down or Southdown rams sire the best lambs. The Dorset Horn may be the most desirable sire owing to his ability to work during the hotter months of the year. He is also more active and not so likely to be cast as the Southdown. However, in the higher rainfall areas, the Romney Marsh may prove a valuable lamb sire, while in the drier marginal areas the Border Leicester can be used.

Irrespective of the breed of ram you select, attention must be paid to his quality and ability to transmit his good characteristics to his offspring. Buying a purebred ram from a good registered stud is a useful way of safeguarding this requirement.

THE MANAGEMENT OF THE FAT LAMB FLOCK.

Joining.

Most of our natural pastures in Queensland are not good enough to rear prime sucker lambs, so we are mainly dependent on crop grazing for their production. Therefore it is necessary to time the joining so the lambing coincides with the growth of the crops suitable for grazing. This often means joining during the early summer—September, October or November—to ensure that the lambs are away by the following July or August.

Unfortunately, during these hot months the fertility of the ram may be impaired. However, with adequate attention good results may be achieved. Shearing, feeding 4–6 weeks prior to joining and/or drenching the rams with a vitamin A emulsion, given twice at three-weekly intervals prior to joining, has improved marking percentages.

In some areas, "flushing" has proved valuable. This means turning the rams and ewes, separately, into a green crop a few weeks prior to joining. Although this practice is very desirable it may not always be possible. Should the ewes be carrying any length of wool, crutching or shearing would be advantageous before joining.

Both ewes and rams need to be in strong condition, but not over-fat, and 2½–3% of rams are usually mated.

A joining period of six weeks is usually sufficient. It has advantages, too, in allowing the lambs to be dropped within a relatively short time of each other, making the whole drop more uniform.

Reasonably small paddocks during joining are an advantage, as they ensure better intermingling of the ewes and rams.

An adequate supply of water and shade is essential.

Feeding the Ewes and Lambs.

Good feeding of the ewes prior to and after lambing helps the ewes to produce strong, heavy lambs and an ample supply of milk to rear them quickly. Aim to have your ewes on a rising plane of nutrition during the last six weeks of pregnancy. This prevents lambing sickness. It is often difficult to increase the amount of feed available to the ewes. However, a fodder conservation scheme, run in conjunction with fat lamb raising, will pay handsome dividends.

General Care at Lambing.

Crutching or shearing three weeks before lambing is an advantage to alleviate fly strike during lambing.

Crows, foxes and eagle hawks can be responsible for low percentages at marking time. Campaigns are best if they are carried on throughout the year and intensified just before lambing.

Walking or riding carefully through your ewes each morning during the lambing season can reduce many losses. Assistance can be given to ewes having lambing trouble and some lambs may be helped to have their first drink.

Marking.

If you mark your lambs at an early age they will suffer fewer setbacks. Lambs can be marked when they are a few days old. However, it is usually more convenient to mark the whole drop together one or two weeks after lambing is finished.

After marking, the ewes and lambs should be turned on to good pastures or a grazing crop.

For a week or two after marking watch the lambs to see they are not troubled by blowfly strike.

Marketing.

Set out to make the article you have to market as attractive as possible. This ensures the greatest returns. Therefore, market your lambs so they can be displayed in an attractive manner. Fat lambs should be marketed direct from their mothers as suckers. Grade them into even lots and market them in uniform lines. It is much better to have a few less lambs going to market than to spoil a uniform line by sending two or three extra lambs which make the line uneven.

It is a good plan to have a pen the exact size of a railway truck and one the size of a sheep transport lorry in your yards. By filling these comfortably and counting the number of lambs, trucking will be made easier and your lambs are less likely to be bruised in transit.

Great care must be exercised when handling lambs to see that they are not bruised. Kicking, hitting or poking with sticks or pulling their wool will leave dark bruised areas which are very conspicuous on the dressed carcase. They are graded down and you are the loser!

PLAN TO REAR MORE LAMBS.

Lambing trials in the Longreach district which are being carried out by the Sheep and Wool Branch of the Department of Agriculture and Stock for the third successive year may show wool-growers how to rear more lambs. At present deaths between birth and marking age reduce Queensland's annual lamb population by more than a third.

Investigations into the value of selecting ewes for their ability to produce and rear lambs are being continued this spring as part of a programme to counter the present heavy losses of young lambs. Selection of ewes on their breeding performances will add another character for consideration in any culling plan.

Announcing this recently, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said the lambing trials at Maneroo Station, near Longreach, this season would be supervised by Mr. J. Wolfe, Assistant Husbandry Officer in the Sheep and Wool Branch of his Department.

In the three years 1949, 1950 and 1951, approximately 10,847,500 ewes were mated in semi-arid tropical Queensland and 5,560,000 lambs were marked. Observations made at that time indicated that 36.4% of the lambs born died before marking. This means that, over the 3-year period, 3,200,000 wool-producing stock were lost to the industry.

There has always been a marked and satisfactory response to feeding ewes prior to lambing, but it has been found nutrition is not the only factor involved and imperfect mothering causes many lossess. As a result, investigations into the part that selection of the ewe breeding flock can play in rearing more lambs were undertaken.

Mr. Wolfe is now observing the trial, recording results and determining the cause of deaths among the lambs.

Is Yarding Sheep During Joining Sound Husbandry?

By S. J. MILLER, Sheep Husbandry Officer.

Is it necessary to yard sheep during joining for high conception rates? This depends entirely on locality. Reasons can be given in support of and against the practice. Before discussing these reasons, it is necessary to have an appreciation of the various conditions under which sheep are bred.

Sheep are sometimes run on land carrying one sheep to the acre. This land is usually well subdivided. They are also grazed on undeveloped land carrying perhaps one sheep to 25 acres. The manager of this latter type of property may consider a paddock in sheep-to-the-acre-country to be a yard! It is the manager of this undeveloped country who has to decide whether yarding is necessary.

The usual practice is to join 2½% rams for about six weeks. This means that one ram is expected to serve 40 ewes. If rams and ewes do not intermingle, the desired results may not be obtained. Where sheep are joined in large paddocks (as big as 20,000 acres), the possibility of rams and ewes not intermingling is increased. By yarding sheep one night a week, an attempt is made to overcome this. In doing so one might get worse results than might otherwise be anticipated.

For and Against Yarding.

The factors supporting the practice of yarding are:—

(1) Rams and ewes intermingle freely.

(2) Rams work when they are being mustered.

(3) Sheep often have to be joined in large paddocks.

(4) Yarding enables the owner to inspect sheep for fly strike and to check the rams for their general well-being.

On the other side of the picture there are several factors against yarding. These are:—

(1) Rams may become overheated if they have to be driven far.

(2) It has been demonstrated that mating has an appreciable effect on the fertility of rams. Rams usually serve more ewes in a set time if they are driven. Mating, plus heat and exercise, may impair the fertility of rams.

(3) Yarding sheep tends to aggravate any blowfly problem.

(4) If sheep are not released by 8 a.m. they may walk for miles and split up considerably. This defeats the purpose for which yarding was intended.

(5) Yarding means more dust in the wool.

What is the Best Thing To Do?

The points against yarding become more important in the low-carrying areas where yarding is often practised.

The conditions which commend yarding can be overcome in other ways in these areas.

If a co-ordinated plan to control fly strike is adopted, there should not be enough sheep struck during a 6-week joining period to warrant yarding. Precautionary measures would have been adopted prior to joining.

The low-carrying country is quite often not well watered. Sheep usually water in large groups at set times, depending on the availability of feed and the time of the year. By mating sheep in paddocks with one or two watering points, it is possible to get the same results as those presumably

gained by yarding, as the sheep virtually "yard" or congregate themselves. This ensures intermingling of rams and ewes—the main argument in favour of yarding. This is accomplished without the hustle and dust associated with a muster.

Therefore, the more undeveloped the country is the more the reasons against yarding become apparent. It is also true that the more necessary it is to ensure that there is ample intermingling of rams and ewes the more undesirable the practice of yarding becomes. In these circumstances, it is perhaps advisable to:—

(1) Join in a paddock with one or two watering points, or

(2) Shepherd sheep quietly into groups in the paddock during the cool of the day.

By adopting these practices the undesirable features of yarding are avoided.

BREEDING SHEEP TO CUT MORE WOOL.

Breeding sheep adapted to Queensland's tropical environment can play a vital part in securing a permanent increase in the amount of wool produced by the State's flocks, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently.

As Queensland is the only State with a big aggregation of wool-growing sheep in the tropics, the necessity for breeding sheep in the environment in which they have to produce wool becomes particularly important, and the fact that the number of Queensland studs has almost trebled in the last 20 years represents a major advance in the industry. It means that more and more Queensland-bred rams are being used in the flocks.

For these reasons, the Department has readily agreed to a request to provide technical assistance at a two-day extension school for sheep men arranged by the Queensland Merino Stud Sheep Breeders' Association and held at Tambo Station, Tambo, in September.

The school, which was restricted to members of the association and their overseers and classers, was designed to show the way in which figures and records can be used to measure progress in sheep breeding. Latest trends in sheep breeding for increased cuts per head were explained. There was a series of lectures as well as practical demonstrations with sheep from Landsdowne Stud.

The stud sheep industry has a great responsibility to the flocks because the breeding policy within the studs directly influences the rate of improvement in the flocks. Higher cuts per head achieved through the efforts of stud-masters are transmitted to the flocks by the rams, and any improvement through breeding is permanent.

To assist in increasing the rate of improvement in the studs, the Department has established a fleece measuring laboratory run as a public utility for use by the sheep industry. Already the 38 studs and flocks using the laboratory are showing that it is possible to double or even treble the rate of improvement through breeding.

The Minister added that Mr. D. M. Archer, of Strathdarr, Longreach, the president of the Queensland Merino Stud Sheep Breeders' Association, had frequently pointed out that Queensland would eventually become the most important wool-growing State in the Commonwealth because fat lamb production trends in southern States were reducing the number of Merino flocks.

The leader of the school was the Department's Director of Sheep Husbandry (Mr. G. R. Moule), and he was assisted by Messrs. S. J. Miller (Husbandry Officer, Brisbane), K. J. Astill (Husbandry Officer, Blackall) and G. R. Morrison (Senior Adviser in Sheep Husbandry, Barcaldine).

ANIMAL HEALTH

Actinomycosis (Lumpy Jaw) of Cattle.

By A. A. SEAWRIGHT, Veterinary Officer.

Lumpy jaw, or actinomycosis, is a chronic infectious disease which occurs among cattle in all parts of Australia, affecting both beef and dairy herds. In Queensland, odd animals are seen affected with the disease in all districts.

Three separate diseases are grouped under the term "actinomycosis." (1) True actinomycosis, which is a disease caused by *Actinomyces bovis*, a parasitic fungus. This disease usually affects the bones of the jaws, causing a bony tumour. (2) A disease mainly of the soft tissues of the head (as opposed to the bone), caused by a bacillis, *Actinobacillis lignieresi*. The tumour in this case is softer, containing abscesses and pus sinuses. (3) Actinostaphylocosis, a disease of the udder associated with chronic multiple small abscesses and hardening of the quarter. This is caused by a bacterial organism, *Staphylococcus pyogenes*.

The feature most common to these three diseases and the one responsible for the confusion over their names is the granular, gritty type of pus.

How the Disease is Caused.

Both *Actinomyces bovis* and *Actinobacillis lignieresi* are ubiquitious organisms and may be regarded as normal inhabitants of the mouth and throat of cattle.

Infection is thought to enter the jaw through the tooth sockets or through an ulcer in the mouth cavity. Lumpy jaw often develops in young cattle in the period between the shedding of temporary teeth and the eruption of the permanent teeth.

In the case of the *Actinobacillis*, where soft tissues only are involved, infection enters through the lining of the mouth and throat and usually causes tumour and abscess formation in the lymph nodes of the head or the tongue. This organism may cause lesions of this kind in any of the soft tissues of the respiratory or alimentary systems. Animals most commonly contract the infection between two and five years of age.

Symptoms.

Lumpy jaw, actinomycosis of the bone, first appears as a circumscribed immovable bony swelling on the upper or lower jaw, usually situated on the face under the eye. The growth may enlarge rapidly, involving a large portion of the face in as short a time as two or three months. This is usually associated with loosening of the teeth on that side and swelling of the hard palate and bones of the nose. Difficulty in breathing at inspiration may also be present.

The skin is usually firmly adherent to the outside of the growth. A break in the skin often occurs over the swelling and the typical thick white or creamy granular pus oozes out. Swellings usually do not enlarge any more after about 12 months and may often appear to heal. However, they usually break out again after a while. The resultant swelling may reach six inches or more in diameter. If one of these swellings is cut open, it is found to consist of spongy bone and proud flesh containing pockets of the thick creamy pus. In the early stages of

the disease the swelling is quite painful to touch and as it enlarges progressively may interfere severely with mastication. An affected animal may then waste away and eventually die.

When the disease occurs in soft tissues the swelling is found to be not painful and not attached to any bone. Usually these swellings are smaller than those attached to and involving bone, and are generally situated under the lower jaw or in the region immediately below the ear. There may be several smaller swellings together in the same area. Often the adjacent lymph nodes of the area are enlarged and hardened.

When the tongue is involved it presents the appearance of "wooden tongue." The tongue is very much enlarged and the muscular tissue is hardened and may contain several small hard nodular abscesses. Often there are several ulcers on the rear upper surface facing the soft palate. With the tongue in this condition mastication is difficult and there is much drooling of saliva. The condition may also affect the back of the throat and large abscesses may be present. Breathing is very difficult and may be accompanied by roaring. This condition can readily be confused with tuberculosis of the throat, which presents a similar appearance.

Treatment.

Lesions in soft tissues usually respond to treatment quite well. The best practice is to cut them out completely if they are not too extensive. The wound can then be treated with tincture of iodine. If swellings are large, they should be opened and the pus drained. The cavities can be packed for about 48 hours with gauze soaked in tincture of iodine, and healing will gradually take place.

In this type of lesion and in tongue and throat lesions, one, two or three injections (given at weekly intervals) of 30 grams of sodium iodide in one pint of water given intravenously often has a specific curative effect. For giving intravenous injections, veterinary assistance may have to be sought. Potassium iodide in the same quantities given by mouth will have an equally good effect.

In the case of hard bony lesions involving the jaw bones, extensive surgical measures with removal of as much diseased bone as possible would have to be attempted. Sodium iodide injections should be given intravenously at the same time and the wound treated with penicillin. Success in the treatment of this type of lesion is not often attained. However, in the case of a valuable animal, this treatment is always worth trying if the swelling is not too extensive.

Travelling Affected Stock.

Actinomycosis is listed as a disease under the Stock Acts. Therefore, cattle affected with this disease are not allowed to travel except under special conditions. Cattle with swellings on the jaw from which pus is exuding ("broken") are definitely not allowed to travel under any circumstances, as this disease is infectious among cattle. In addition, there is the possibility of a human infection from such an animal. Where the animal intended for travel has actinomycosis, it may be travelled if in the opinion of a Stock Inspector the lesion is not open and discharging pus. Under these conditions, a Special Permit may be issued for the beast's removal direct to an appropriate meatworks, there to be killed on the owner's account.

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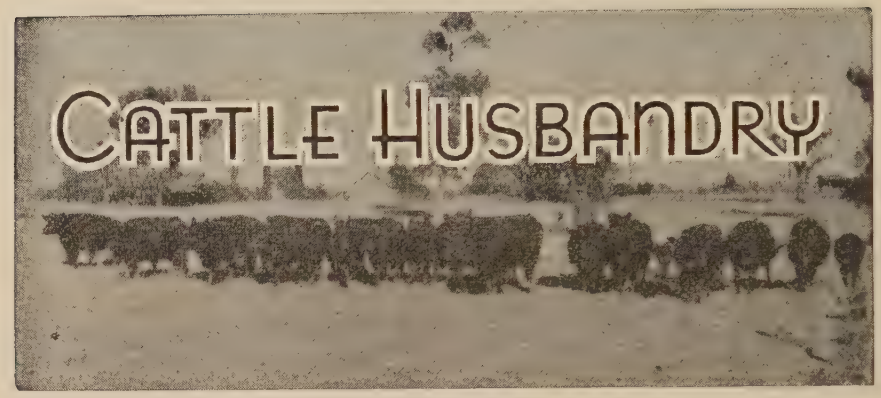

Dehorning Cattle.

BY OFFICERS OF THE DIVISION OF ANIMAL INDUSTRY.

Dehorning has now become a recognised practice in a great number of dairy herds in Queensland. Whilst dehorning is accepted as good husbandry by most commercial dairymen, many stud breeders, though recognising the economic advantages of dehorning, claim that the removal of horns detracts from the appearance of show animals. In fact, a dehorned beast is rarely seen in the show-ring.

The presence or absence of horns should not be allowed to distract attention from the points which really matter—the production of butter and meat, neither of which has anything to do with horns.

Farmers become accustomed to the sight of dehorned stock and soon appreciate the ease of handling and the freedom in moving among their dehorned cows. Breeders of polled cattle would not think their cattle improved if horns were grafted on. It is not horns which give Ayrshires a high place in the milk world, but good udder conformation and their ability to produce milk.

In the show-ring, attention should be concentrated on economic points, for after all, farming is a business. If the dehorning of cattle leads to greater production of milk and decreases the risk of injury in the yard, then dehorned cattle should not lose points when being judged in the show-ring.

It is claimed, by those opposed to the practice, that dehorning of adult cattle is cruel and for that reason should not be undertaken. Pain is certainly inflicted at the time of dehorning, but this pain, though acute, is fleeting and in no way as severe or as dangerous as that inflicted by cows ripping each other with sharp pointed horns. It is only necessary to see animals severely horned and trampled during trucking to realise the cruelty of enclosing aggressive horned animals in confined yards or trucks.

It is surprising that dehorning has not become a general practice throughout the world, as it has practically everything in its favour and if properly carried out little against it.

ADVANTAGES OF DEHORNING.

The advantages of dehorning are summarised in this section.

More cattle can be kept in the dairy yard; they can be handled with less risk of personal injury; and the food is used more economically.

Cows are quieter in the yard when they are not expecting a horn "poke," and milking becomes quicker with less trouble in bailing up.

More cows can be put onto a limited grazing area, and strip grazing is more easily controlled. When the "boss" cow has horns she will frequently corner and rip a timid beast, and if this bullying goes on there will be a resultant depression of milk yield in some cows. Bullying is not unknown amongst hornless cattle, but usually with the loss of their horns, horned breeds lose their fighting instincts.

Plate 1.

Dehorned Dairy Cows Reclining Contentedly After Feeding.

Plate 2.

Dehorned Hereford Steers Grazing in a Small Oat Paddock.

Plate 3.

An Easily Controlled Group of Polled Aberdeen Angus Cows and Calves.

When limited troughing space is available, it is frequently noted that some animals, as soon as they have satisfied their thirst, promptly attack their neighbours, causing injury to other cattle and to the troughing. This is eliminated if stock are dehorned.

During trucking of fat cattle, horning will cause marked depreciation of value of the carcases consigned to abattoirs, apart from losses due to tears in the hides. When trucking, it may be possible to include one more animal once they have been dehorned. Dehorned cattle can move their heads freely in a truck without the possibility of horns entering other cattle with resultant injury.

As previously mentioned, a loss of horns causes an immediate change in temperament. Dairy cows, once dehorned, on being turned into a crop graze like sheep. They keep their heads down until they have eaten sufficient feed and then retire to the shade to ruminate.

Close concentration of cattle on a similar area allows more efficient grazing of pasture at its most nutritious stage of growth.

Bulls are a constant source of danger, particularly on dairy farms, where it is frequently necessary to work them through milking yards. Some breeds of dairy bulls, too, are temperamental and for that reason more dangerous than beef breeds. The removal of horns has a remarkable influence on the temperament of even the most vicious bull. For this reason, dehorning of bulls in all dairy herds is strongly recommended.

ELIMINATION OF HORNS BY BREEDING.

The most satisfactory way of getting rid of horns is to breed them off, and this can be achieved, with beef cattle, if a certain breeding programme is followed.

Polledness is strongly dominant and polled sires will throw a large percentage of polled calves when mated to horned females. The first cross will be all polled. The second generation, if interbred, will produce roughly three polled calves to every one horned calf. This is represented diagrammatically in Plate 4.

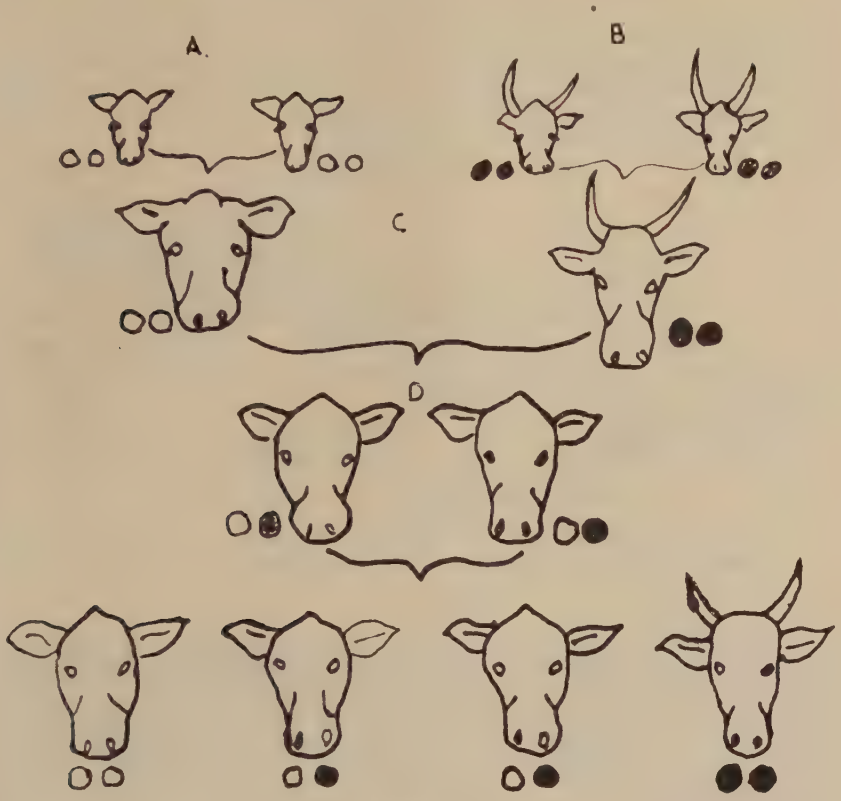

Plate 4.

Diagram Showing how Polledness is Transmitted.—The character for polledness is represented by an open circle and that for horns by a filled circle. At the top, two polled animals are mated to give a polled animal and two horned animals to give a horned animal. If these two animals are mated, they give polled offspring. Two such polled progeny when mated give three polled animals and one horned in every four on an average. Two of the polled offspring have the character for horns as well as for polledness, and though polledness is dominant in them, some of their progeny are likely to be horned.

However, if a sire which is pure for polledness is regularly used, all his progeny will be polled. Unfortunately, there are no recognised pure polled breeds of dairy cattle in Australia, and dehorning is necessary with this type of animal.

ANATOMY OF HORN AND POLL.

Before considering methods of dehorning, it is desirable to give some attention to the anatomy of the horn and poll. (Plates 5 and 6.)

Just below and on either side of the frontal eminence or poll is a "processus cornus," or horn core, for the support of the horns. Horn cores vary in size, shape, length and direction and are of elongated conical form. The external surface is rough and porous, and marked by numerous grooves and holes for blood vessels. In the fresh state it is covered by the horn-forming cells, or corium, of the horn.

The interior is excavated to form a number of irregular spaces divided by bony walls and communicates with the frontal sinus, the whole space being lined with mucous membrane.

The blood supply to the horn (Plate 6) is supplied by a special artery, the artery to the growing area of the horn, which is a branch of the internal maxillary.

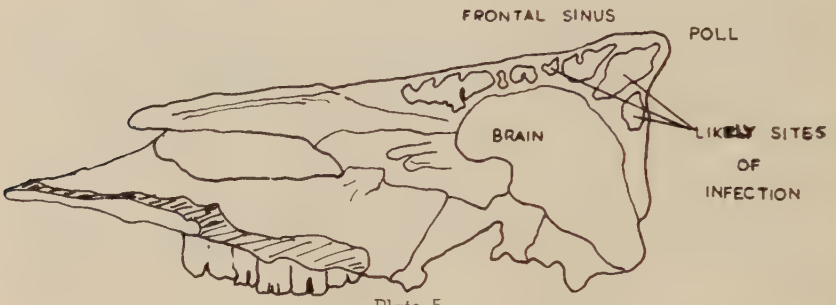

Plate 5.

Diagram Showing the Location of Sinuses in Relation to the Poll.

The nerve supply to the horn is by a branch of the lacrymal nerve which emerges from a foramen opening in the skull (Plate 6) above the eye and runs below a ridge running up to the horn, where it divides just under the skin.

The growing area of the horn can be compared to a similar growing area, the coronet, on the horn of the hoof. Once either of these is injured there will be no further growth of horn. If the growing area is not removed with the horn, it will result in ugly stubs growing later.

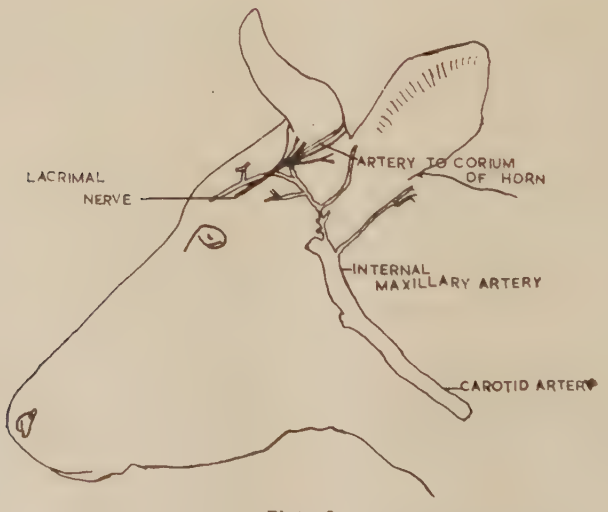

Plate 6.

Diagram Showing the Position of Nerves and Arteries.

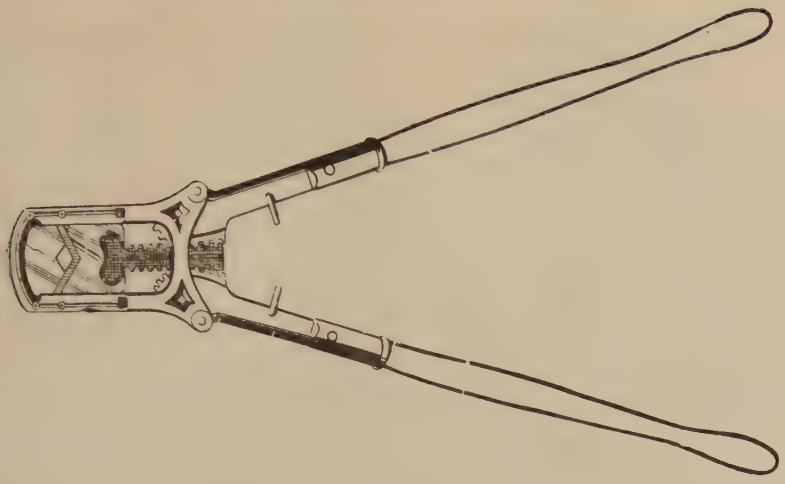

Plate 7.
A Suitable Dehorner for Adult Cattle.

Plate 8.
Dehorning with a Guillotine Dehorner.

DEHORNING OF ADULT CATTLE.

Guillotine Dehorner.

Best results are obtained when dehorning is undertaken on calves under six months old. At times it may be considered advisable to dehorn mature cattle, and a special large type of dehorner is necessary for this operation. Many dehorners are on the market, but only those which are massive and strongly built, and lend themselves to a prompt, clean removal of the horn in one movement, should be used.

There is only one type of dehorner (Plate 7) which can be considered suitable for adult cattle. It is constructed on the principle of a guillotine and the blades, one of which is fixed, are in a frame. When the blades have been placed in the correct position, a quick purchase is obtained by closing the handles, which operate a rack and pinion gear. The blades overlap when closed and the horn comes off quite evenly.

Some form of restraint is necessary to ensure adequate control of the animal, and if a large number of beef cattle are to be treated, a special dehorning bail is essential (Plates 9 and 10.)

When a horn is being removed, the anatomy of the region should be kept in mind and the dehorner so placed that approximately a quarter of an inch of hair and skin is removed with the horn. This destroys the growing area and ensures that there will be no regrowth of the horn. Bleeding may appear to be severe following dehorning of mature cattle, and although usually not considered dangerous, it is objectionable and may alarm the inexperienced operator.

The bleeding can be controlled by the application of a ligature, tied around the base of the horn and across the top of the head and then twitched tightly by drawing the two pieces of the cord together across the top of the poll. This method of control should be employed with dairy cattle, but it is seldom used with beef cattle, owing to the necessity of re-yarding the animals to remove the ligature.

If the arteries are still spurting an hour after the operation, the animal should be caught and the haemorrhage stopped. This can be done by applying the ligature or by taking up the arteries with forceps and tying them off with cotton. If a sufficient amount of horn is taken, it is relatively easy to pick up the arteries with artery forceps and twist them off. This will stop a spurting artery. If the ligature is not applied, the bleeding can be controlled to a certain extent by the searing iron, or by use of a suitable powder. A dry dusting powder has been found more satisfactory for use immediately after dehorning than one with an oily or tarry base. Satisfactory application of the latter dressing is difficult. A suitable dusting powder may be prepared by mixing one part of boric acid, one part of zinc oxide, one part of powdered alum, and six parts of powdered starch.

Tipping.

Tipping is often practised as an alternative to dehorning in mature cattle, particularly bulls, dairy cows and forward steers. Tipping consists of the removal of about two inches from the tip of the horn, so that the "quick" or sensitive portion becomes exposed. It can be carried out with ordinary dehorners or with a saw. As a result of this operation, the extremity of the horn becomes tender for a considerable time and the animal will refrain from using it. Even when the tenderness disappears, the animal is less likely to be aggresive and cause ripping or bruising.

Time to Dehorn.

Dehorning is best done in the cooler months of the year when the fly population is at a minimum. Fly strike often follows dehorning in the hotter months when flies are bad.

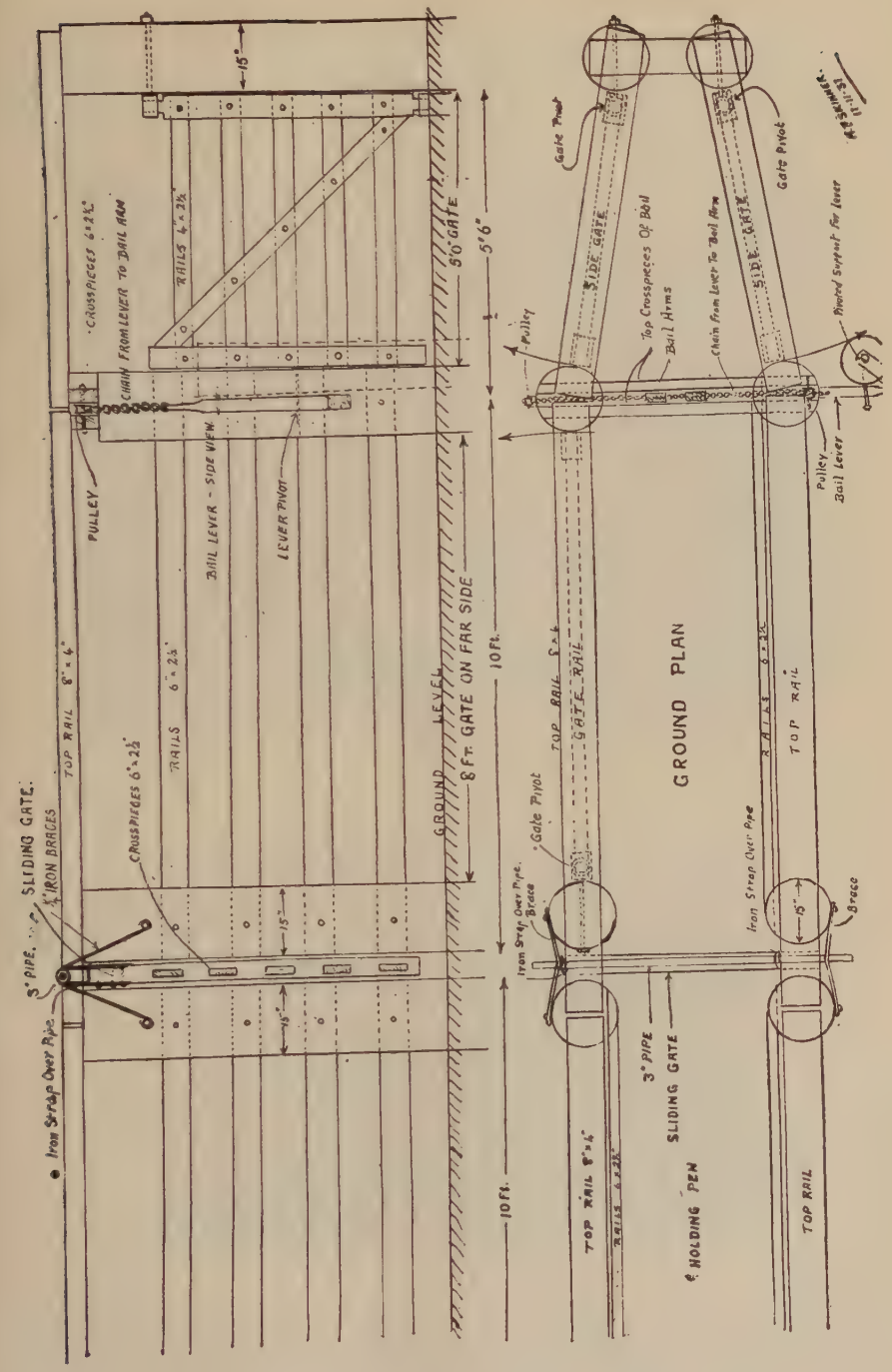

Plate 9.

Plan of a Dehorning Bail and Crush.

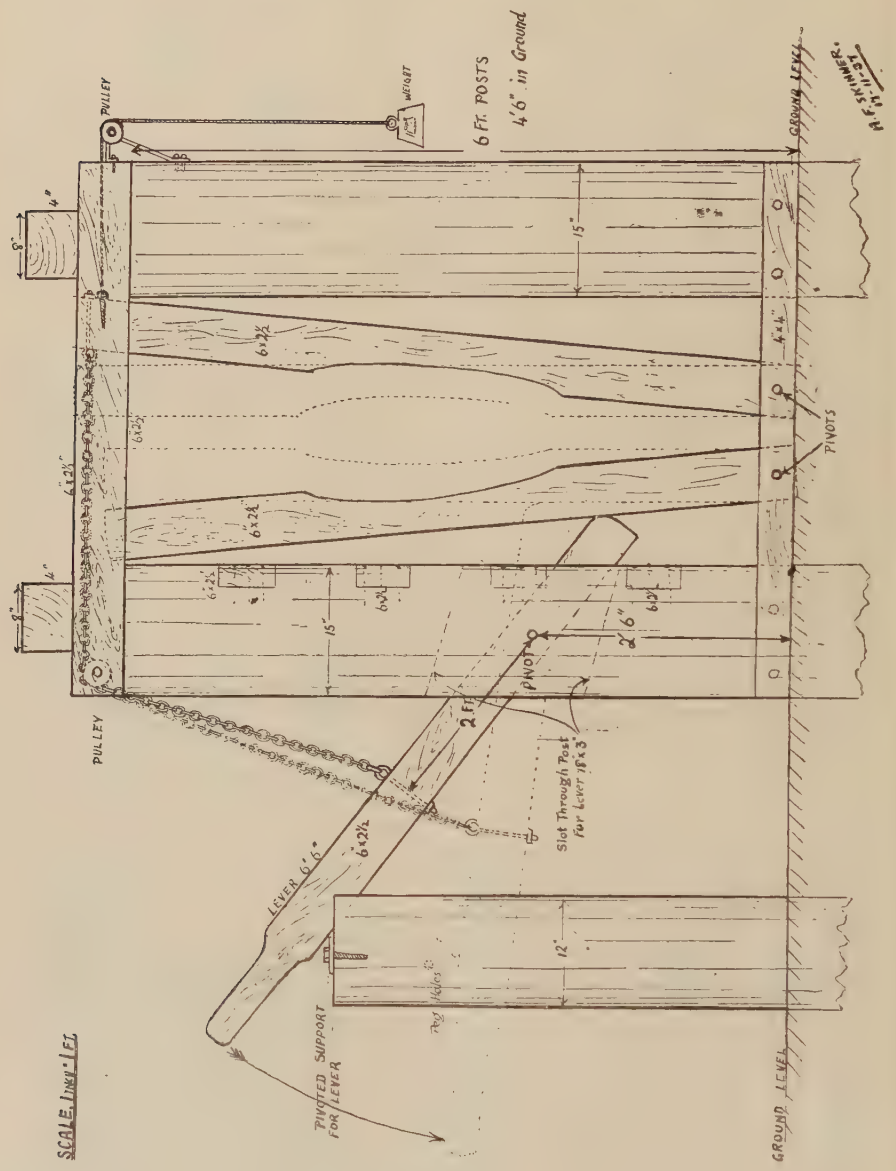

Plate 10.

Front View of the Dehorning Rail shown in Plate 9.

Precautions and Aftercare.

Lysol is probably the best antiseptic to use. Instruments should be soaked for some hours previous to dehorning in 5 per cent. solution of lysol. A bucket of 2 per cent. lysol or dettol should be kept handy so that the dehorners can be immersed therein between operations. Suitable fly-dressings are B.K.B. and B.T.B., both of which are produced commercially, and oil of citronella, which has long been used as an insect repellant.

If fly-strike is experienced, and a fly dressing applied, liquid should not be allowed to enter the sinus because of the risk of infection. If the sinus becomes infected, it is very slow to heal because of poor drainage. may be necessary to syringe out maggots with a weak antiseptic solution, tilting the head to make sure of drainage. A fly repellant is then applied.

Plate 11.
Result of Dehorning by Guillotine Dehorner Three Weeks After the Operation.

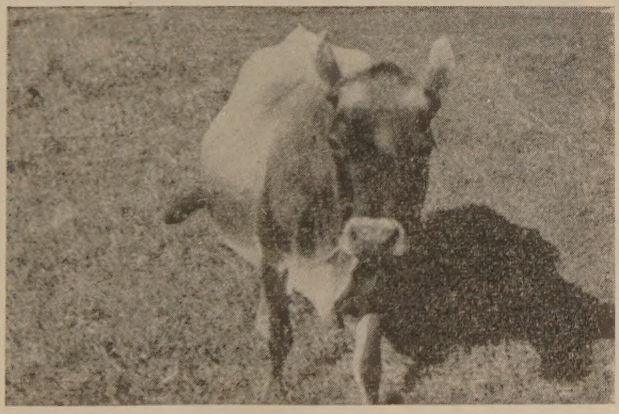

Plate 12.
A Typical Poll After Dehorning.

If, as sometimes happens when conditions are not ideal, fly strike is experienced, the hair around the horn should be clipped with scissors. It

DEHORNING OF CALVES.

There are three methods of dehorning calves, namely, chemical, cautery or hot iron, and mechanical.

Chemical Dehorning.

Caustic Sticks.—Calves up to two weeks can be treated with caustic soda or caustic potash. The latter is preferred, since caustic soda suffers from the disadvantage of having a tendency to spread, and thus to injure the surrounding tissues.

An area the size of a two shilling piece should be clipped over each "button"; a ring of vaseline about one inch wide is next smeared around the clipped area to check the caustic from running into the calf's eyes. The caustic stick is then moistened and rubbed over the button with a gentle rotary motion and the rubbing continued until blood just starts to seep through the seared spot.

Too little rubbing will leave unsightly "scurs." On the other hand, too much caustic may cause excessive burning and scarring of the head. The caustic should only be applied to the area of skin covering the horn bud.

Afterwards, the calf should be tied up for at least six hours in a place where it cannot get wet. This will prevent scratching and rubbing of the treated area, which is likely to cause burning in other places and blindness if the caustic gains access to the eyes.

Antimony Trichloride.—In recent years, antimony trichloride in a solution of flexible collodion has been found to be a very satisfactory dehorning agent.

The solution can be made up by any chemist from the following formula:—

	Per cent.
Antimony trichloride ..	28
Salicylic acid	7
Flexible collodion ..	65

The material is easy to apply and the solution dries quickly into a firmly adhering flexible film which destroys the underlying tissue with much less pain than caustic sticks. Added to this, there is no danger of weeping

Plate 13.
Calf Dehorned at Birth With a Caustic Stick.

It must be borne in mind that caustic is injurious to skin and clothes and the user should either wear rubber gloves or use a paper wrapping for safe handling.

fluid running into the eyes with resultant blindness.

The procedure is simpler than the application of other caustics. The hair around the buttons is clipped, the

button cleansed with methylated spirit, and the solution applied. Using a brush, the mixture is applied to the centre of the horn, to cover an area the size of a sixpence. The animal need not be tied up or kept out of the rain. Again a little practice is required before complete success can be expected.

The solution gives best results if applied in the first nine days of life. After this period, it can be used fairly successfully if the top of the button is cut off with a pair of sharp curved scissors.

An alternative method of dehorning young calves is by the application of a special searing iron over the horn bud. This has become a popular method overseas. It is simple, efficient, safe and only slightly painful. A special debudding iron is used for this operation (Plate 14).

outer ring of metal which is one-eighth of an inch thick and five-sixteenths of an inch deep, with an internal diameter of half an inch. The iron is mounted on a wooden handle for convenient use.

If fire-heated irons are used, it may be found more convenient to have several irons with various sized cones suitable for calves of different ages. Whilst one iron is being used, the other iron could be in the fire heating. Dehorning by this method is best done at three weeks of age.

Electric soldering irons have been adapted to form efficient cauterisers (Plate 14).

With the calf suitably controlled, the iron, heated to a cherry red colour, is held over the developing horn bud to sear a complete ring of tissue around it to prevent growth. It is here that

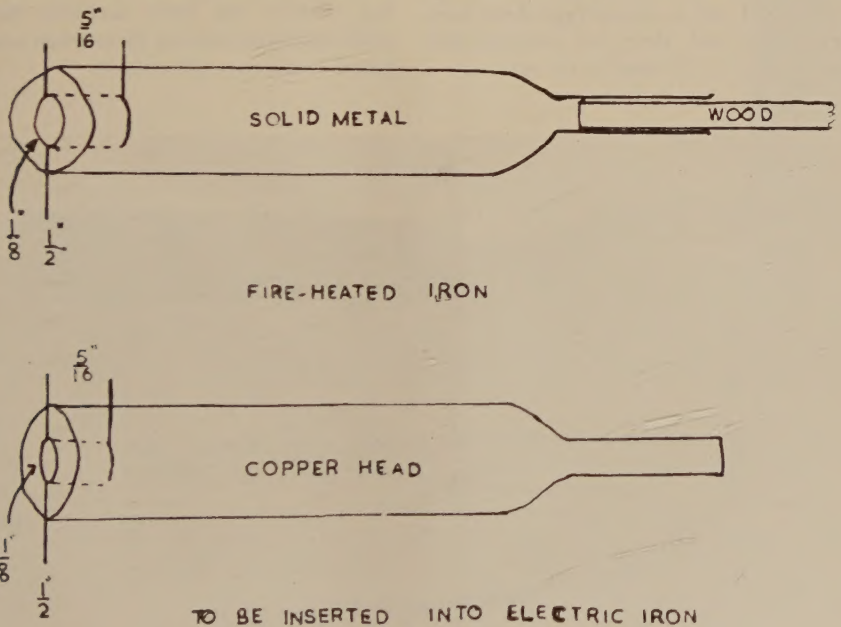

Plate 14.

Sketches of Debudding Irons.

The end of the iron is hollowed to form a dome-shaped depression five-sixteenths of an inch deep in the centre and measuring half an inch across. This depression is surrounded by an

the benefit of the wooden handle becomes apparent, for the iron is then turned completely around several times until the base of the horn is completely encircled by a copper

coloured ring. The circulation to the horn is thus destroyed in less than thirty seconds and the horns drop off by themselves in due course.

There is no wound left for flies to enter and no risk of sinusitis.

Cautery would appear to be the best method.

Mechanical Methods.

Calves up to three months old may be treated by taking out the centre of the horn bud by means of a special instrument or a sharp knife. This may be followed with advantage by the application of a searing iron. When calves are approximately three months old, the horn core begins to grow out from the skull and horn removal then involves the opening of the frontal sinus. The size of the opening varies with the age of the calf, but it usually closes in from a week to a month, when the wound should be completely healed.

Special cup or scoop type dehorners are used and they are suitable for cattle up to 12 months of age.

The animal should be thoroughly restrained in a dehorning bail, or the special equipment used for branding beef calves, before the operation is attempted. The hair around the base of the horn should be clipped if it is long. The dehorner should be applied so that a quarter to half inch of skin is taken with the "bite." The horn is removed in one movement by applying strong pressure on the handles of the dehorner. No dressing should be applied, except in a fly wave, when a fly repellant is used.

A specially adapted curved sharp knife (Plate 15) is used fairly extensively in beef herds. The horn bud is taken out with a clean cut of the knife.

Other mechanical means of dehorning include gouging forceps and gouging chisels, but these methods have nothing to recommend them when compared with cup dehorners.

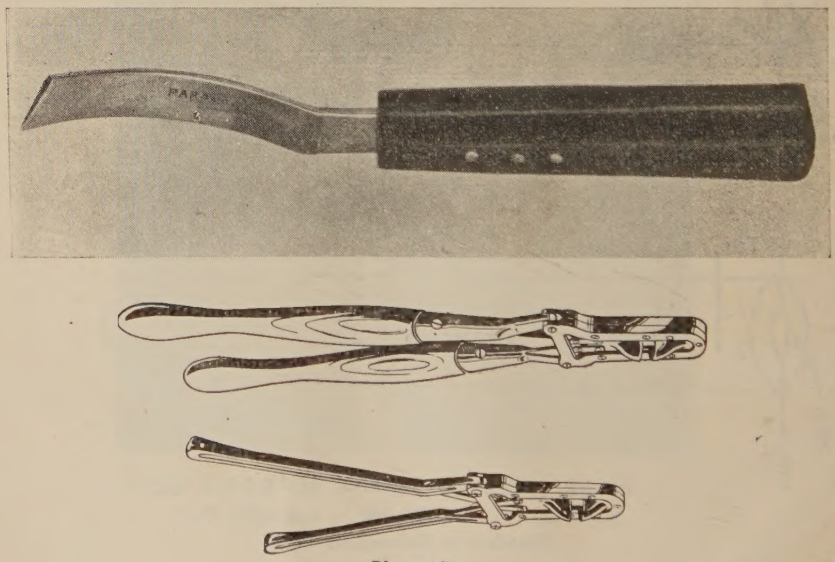

Plate 15.

Calf Dehorning Instruments—Curved Knife and Gouge Dehorners.